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The Effect of Bid Evaluation Rule on Participation in Public Procurement Competitions with Endogenous Entry

Master's Thesis
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Tiivistelmä

Tämä tutkielman tavoitteena on tutkia valintaperusteen merkitystä julkisten hankintojen saamalla tarjousmäärälle tilanteessa, jossa osallistumisesta syntyy tarjoajalle kuluja, ja jossa tarjoajien määrä määräytyy endogeenisesti. Suomessa julkiset hankinnat järjestetään useimmiten niin, että hankkija julkaisee ja sitoutuu valintaperusteeseen ennen tarjousten vastaanottamista. Tarjousten vastaanottamisen jälkeen valintaperuste määrää hankintakilpailutuksen voittajan. Valintaperuste määräytyy useimmiten joko pelkän hinnan perusteella tai sitten sekä hinnan että laadun perusteella.

Tämä tutkielma osallistuu aiempaan keskusteluun julkisten hankintojen järjestämistapojen eroista pyrkimällä näyttämään miten, jos ollenkaan, hinta-laatuperusteen käyttäminen vaikuttaa markkinoilla toimivien potentiaalisten toimittajien käyttäytymiseen verrattuna pelkän hintaperusteen käyttämiseen. Analyysissä keskitytään nimenomaan tilanteisiin, jossa markkinoilla on runsaasti mahdollisia tarjoajia, jotka osallistuessaan joutuvat maksamaan kuluja osallistumisesta. Tällaisessa tilanteessa, markkinoilla toimivien potentiaaliseen päätökseen osallistumisesta vaikuttaa kilpailun houkuttelevuus. Ennakko-olettamana on, että erinäisten mekanismien kautta, hinta-laatuperuste saattaa joko houkutella tai lannistaa mahdollisia tarjoajia.

Analyysi perustuu konsultti– ja informaatioteknologiayhtiö Cloudia Oy:n ylläpitämään dataan julkisista hankinnoista Suomessa vuosilta 2012-2017. Analyysi keskittyy kuntien ja maakuntien tekemiin rakennusalan hankintoihin. Empiirinen analyysi perustuu OLS-malleihin, jossa havaittuja eroja pyritään kontrolloimaan mahdollisimman hyvin.

Löydän, että hinta-laatuperustetta käyttävät hankinnat saivat nollasta 0.7:ään enemmän tarjouksia kuin hintaperustetta käyttävät hankinnat. Tulokset eivät ole tilastollisesti merkittäviä, mutta tulosten etumerkki on johdonmukaisesti positiivinen.

Aiempi tutkimus on näyttänyt, että hinta-laatuperusteen käyttämisellä on taipumus johtaa voittaneiden toimittajien voittomarginaalien kasvuun. Ehdotan, että tämä on pääasiallinen tekijä mahdollisen positiivisen vaikutuksen takana.

Avainsanat Julkiset hankinnat, kilpailutus, valintaperuste, hinta-laatuperuste, endogeeninen osallistujamäärä, osallistumismaksu, Suomi, rakennusala

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Abstract

I study the effects of bid evaluation rule on the participation of potential bidders to public procurement competitions when entry costs exist, and the entry is endogenous. Public procurement design, where the ranking of offers received in an open and competitive bidding phase is based on pre-stated bid evaluation rule, is the most common public procurement protocol in Finland. In large majority of the procurements, bid evaluation rule is based on either price only, or to a scoring rules that considers both price and quality. My contribution is to examine the possibility, that the choice between the two bid evaluation rules can either attract or deter potential bidders contemplating the participation to the public procurement competition. Because entry cost exists and potential bidders are numerous, the number of bids a procurement receives is affected by how lucrative the bidders see the participation. The thesis will introduce a few mechanisms how the choice of the bid evaluation rule could potentially impact the lucrativeness, and thus the number of offers a procurement receives.

The analysis is based on public procurement data that procurement consultancy and information technology firm Cloudia Oy collected from years 2012 to 2017. The analysis focuses on construction procurements made by municipalities and public regional organizations. Identification is based on controlling the observable factors.

The results from the regressions show that the procurements using scoring rule instead of price-only rule received zero to 0.7 more bids. Results are not statistically significant, but the estimated effect is consistently positive. I suggest that the largest driver for this potential positive effect is the tendency of price and quality auctions to leave larger profit margins to the winning supplier that is documented by earlier studies.

Keywords Public procurement, competitive bidding, bid evaluation rule, scoring auction, entry, entry cost, endogenous entry, Finland, construction works

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1 Introduction

OECD countries spend 12% of GDP on public procurements[1]. At the time of writing, at the end of May 2021, the value of ongoing public procurements in the electronic procurement platform HILMA in Finland was 8.6 billion euros[2].

In Finland and EU, non-minor public procurements rely heavily on procurement design that is based on competitive bidding. EU directives in the last 15 years increased the reliance of organizing open procurement auctions with predefined bid-preference rule, in the aim of decreasing unwanted behavior such as corruption and increasing the cost efficiency of public procurements. In this type of public procurement design that relies on competitive bidding, it is in general critical to the performance to attract enough bidders. Tukiainen and Jääskeläinen (2019) have shown by using general data about Finnish public procurement that median number of bids was just two across all the sectors, and as much as 30% of the procurements didn't receive any offers, all of which is indicating that there may be dire need for procurement practices that can induce entry.

While designing the procurement, a procurer has certain choices to make that can impact the end results, one which is the choice of the bid evaluation rule. The bid evaluation rule is the predefined function of how the procurer plans to rank the received bids. In Finnish public procurement, the bid evaluation rules can be put to two categories: price-only bid evaluation in which the lowest valid bid wins the project, and price and quality scoring-based bid evaluation in which the best combination of price and quality wins. The competitive phase of the lowest price procurement is similar to a first-price auction, while the competitive phase in price and quality-based procurement is called a scoring-auction. In this paper, I examine the possibility that in public procurement auctions with endogenous entry, the bid evaluation rule affects the entry measured as received valid bids from distinctive bidders.

I will use the same data about Finnish public procurements as Tukiainen and Jääskeläinen (2019), but I will focus only on construction sector in order to increase the internal validity of the results. Data is supplied by procurement consultancy and software firm Cloudia Oy that was a chosen provider for the centralized electronic database of public procurements in

[1] Source http://www.oecd.org/gov/public-procurement/ Accessed 31.5.2021
[2] Source https://www.hankintailmoitukset.fi/fi/ Accessed 31.5.2021

Finland. Data includes calls for tenders, offers, and supplier registrations to a website HILMA where the calls for tenders were published.

According to previous studies on the first-price auctions and scoring auctions, the scoring auctions tend to lead to higher quality but also higher price (Che, 1993). However, there are few studies considering the potential entry effect of a bid evaluation rule when the entry to the auction is endogenous. If scoring auction would have an entry-inducing effect, that would then mitigate the increased procurement costs. On the other hand, if scoring auction had entry deterring effect, the cost of procurement would increase even more than previously estimated.

I use an identification based on observables to empirically compare the performance of first-price auctions and scoring auctions in terms of received offers. Procurer has in most cases freedom to choose which bid-evaluation rule to use in each procurement. I also address the potential problem of endogenous decision making where the procurer uses own estimation about the received bids to influence the decision about the bid evaluation rule by using the registration data. Every time a supplier wants to see the whole call for tender document, it has to make a free-of-charge registration that is then visible in the data. This allows me to control the market size, measured as number of potential bidders.[3] Comparing the two bid evaluation groups while keeping the market size allows interpretation that increase in entry was due to increased lucrativeness of the competition to the potential bidders.

I find that before adding any controls, procurements with price and quality scoring receive one more offer on average than procurements with price-only scoring. Estimates from the controlled regressions for the effect of scoring auction instead of lowest-price auction varied between zero and 0.7 offers, or zero to 15% in terms of percentages. Estimates were not statistically significant, but quite consistently positive. The results imply that the procurement format with scoring auction was perhaps more lucrative to the potential bidders than the format with first-price auction. I also show that at least in the available data, the marginal effect of scoring auction appears larger when the number of potential bidders is four and above, and smaller when the number of bidders is below four. This will weaken the significance of the potential effect to the final procurement outcomes because the benefit of an additional bidder is in general believed to be diminishing.

[3] While making the decision, procurer probably knows the market size, but the actual entry is unknown. Rational procurer could react to lower market size by choosing the potentially more entry inducing bid evaluation rule, if that knowledge is available to the procurer. That is controlled by using the number of registrations.

The consistently positive estimates for the use of scoring auction were somewhat surprising, given that it is easy to see why scoring auction would be more burdensome and costly to participate in. But the difference can be explained by the tendency of scoring auction to leave more money on the table. That nicely demonstrates the dilemma of inducing entry when the entry to the auction is endogenous; all measures that aim to squeeze some of the supplier surplus to the procurers will make the competition less lucrative, lead to decrease in entry, and will mitigate the potential benefits, meanwhile all measures that offer more profit to procurers will increase entry and mitigate the increase in procurement costs by increasing competition in the bidding phase.

I also spot a pattern in the data of using quality criteria in scoring auction as a way of adding reputational mechanism to the procurement process. That relates to previous studies about buyer's discretion (Bajari, McMillan, & Tadelis, 2009; Bandiera, Prat, & Valletti, 2009; Coviello, Guglielmo, & Spagnolo, 2018), and especially Spagnolo's work on reputational mechanisms, such as (Spagnolo, 2012).

This study also relates to previous literature about scoring auctions. Theory of scoring auctions is well explained by (Asker & Cantillon, 2008; Asker & Cantillon, 2010; Che, 1993). Empirically the benefits of the scoring auctions are shown for example in (Lewis & Bajari, 2011).

The idea and modeling of endogenous entry in this paper comes from (Levin & Smith, 1994; Samuelson, 1985). In the former, the private costs are unknown to bidders before entry, and in latter there is perfect information about private costs.

I also shortly discuss potential favoritism in Finnish public procurement. I find that bidders who showed preference for scoring auctions were more likely small and medium sized local or regional enterprises, whereas bidders who showed preference for first-price auctions were more likely large, non-local or regional enterprises. This relates to work by Krasnokutskaya and Seim (2011) about bid preference programs and Hyytinen et al. (2018) empirical example of how favoritism changes bidding behavior.

The next section includes theory and background needed to understand the potential mechanisms in play in public procurement auctions and introduces potential forces that would explain how bid evaluation rule can affect the entry. In section 3, I summarize relevant aspects of Finnish public procurement. Section 4 introduces the data used in the study and explains how different variables are created. Section 5 describes the identification strategy and some modeling choices, and shows important descriptive statistics. Section 6 shows results and discussion. The paper finishes with short conclusions in section 7.

2 Literature review

2.1 Objective of public procurement

Procurement in public sector is commonly more regulated than in private sector. In fact, the latest trend in Finland and EU has been towards increasing the regulation in public procurement. From economics point of view the objective of public procurement is to maximize the social surplus. Social surplus is maximized if the public procurement design efficiently allocates public procurement contracts to the most efficient suppliers. If shadow costs of public spending are also considered, the information rents paid by the public procurer to the winning suppliers should be minimized. The latter means that optimal public procurement design shouldn't leave excessive profits to the suppliers.

2.2 Procurement design

2.2.1 Buyer's discretion versus rule-based procurement practices

On the spectrum of procurement designs, the two opposites are buyer's discretion-based models and rule-based models. In a buyer's discretion-based model the procurer official has a lot of power in deciding the winner of the contract. An example of this was the beauty contest model that was used in Sweden and described by Hyytinen et al. (2018). In the model, procurer received offers from the potential suppliers, but was largely free to choose the winner of the contract independent of the price offers. In the rule-based model, the procurer *ex ante* commits to a preference rule that will define the winning bid. Rule-based models are usually competitive auctions.

There is a tradeoff between the two models in terms of qualities offered. Rule-based models are thought to be transparent and reduce corruption and other misuse of power, but they are also thought to be more burdensome. EU regulation during the last two decades has supported a more rule-based model. Rule-based models have in general support from the economists as well. Klemperer (2002) studied spectrum auction designs and outcomes, and concluded that even after considering the problems in the execution, rule-based auction probably performed better than beauty contest-based models.

A major benefit of a rule-based competitive model is that it decreases the procurement costs by introducing a real competition among the potential suppliers, making them bid lower. However, some empiric studies have demonstrated that the reality is more complex than that.

A great example of this were the results from Hyytinen et al. (2018), that compared the procurement outcomes from auctions of cleaning contracts between beauty contest model and rule-based model. Against the theory and general assumption, the procurement costs were not lower in rule-based procurements. Authors found that the entry would have been smaller in rule-based model, if procurers hadn't re-bundled the contracts to make them more attractive. They also found that in the beauty contest model, the procurers were favoring the less cost-efficient in-house units which then made other bidders bid more aggressively. Even though the more efficient bidders won more often in the rule-based model, their bids were higher, than when they were bidding in beauty contests. The rule-based model probably improved the allocation of contract to more efficient suppliers because lower cost bidders won more often.

A claim that rule-based auctions may benefit from at least some buyer's discretion is largely supported. Authors Coviello et al. (2018) claim that based on their empirical results, even though the increase in buyer's discretion in otherwise rule-based model did lead to repeated wins by the same supplier, the procurement outcomes may not have been any worse when buyer's discretion was allowed. The positive effects of long-term relationship between procurer and supplier may be larger than the negative outcomes, such as corruption, that are commonly linked to the larger buyer's discretion. Furthermore, by comparing procurement prices of low complexity goods in Italy Bandiera et al. (2009) found no more corruption in more autonomous supplier organizations that were able to use more buyer's discretion. Instead, they found that more autonomous procurers seemed to have lower procurement costs as well.

Others have shown that the fit of a rule-based competitive auction is dependent on what kind of product or service is procured. Bajari et al. (2009) pointed out that in the private sector, where the procurement process is less regulated but incentives are generally thought to well encourage efficient practices, 44% of construction projects in Northern California were procured by using negotiations, which is a model based more on buyer's discretion than predefined rules. Authors argue that more complex projects that are prone to ex post adaptations should be procured by using negotiations, whereas less complex projects should be procured by competitive auctions. Similar arguments are presented also by Tadelis (2012). Tadelis' hypothesis is that the best way to design a procurement for a complex project is to use cost-plus contracts, low level design completeness and negotiation, and the best way to design a procurement for a simple project is to use fixed price, high level design completeness and competitive bidding.

2.2.2 First-price versus scoring auction

Currently the rule-based models are a default option for larger public procurements in Finland and in EU. In rule-based models the procurer commits *ex ante* to a bid evaluation rule, with the purpose of making the procurement competitions fair and transparent. The most familiar rule-based model for economists is the first-price auction that needs no further introduction. Another rule-based model relevant to the Finnish public procurement context is a scoring auction. Both designs rely on predetermined bid evaluation rule. When in first-price auction the winner is determined by the price, in scoring auction the ranking of the bids depends on the price and one or more quality measures. In scoring auction both price and quality form a score according to the bid-preference function that then decides the winner.

Theory for the scoring auctions, or multidimensional auctions as the more general model is formally called in the literature, is introduced for example by Che (1993) for two-dimensional auctions, and Asker & Cantillon (2008) and (2010) for multidimensional auctions. Che shows that when the quality is contractible, even a naïve scoring auction, where the scoring of quality dimension reveals the procurer's preference, performs no worse than price only auction where quality is fixed. According to Che, use of scoring auction leads to higher costs and higher quality. Asker & Cantillon go further and say that in various theoretical scenarios, scoring auction dominated other models including price only auction with quality threshold and negotiation.

The potential benefits of a scoring auction in a situation, where the quality is contractible and product differentiated, is nicely demonstrated empirically by Lewis & Bajari (2011). Authors studied highway repairs in California, where there was a clear and large negative externality for extra time the repair would take. By comparing two procurement models, where in the first one the time was accounted to the bid preference rule and in the other the repairs were procured by price only auctions. Authors find that although the procurement costs were significantly higher in the scoring auction, just like Che (Che, 1993) was implying, the value in saved negative externalities were significantly larger, implying that the use of scoring auction in that context would clearly increase the total welfare.

The benefits of the scoring auction come from the flexibility in the price-per-quality dimension. When in the differentiable product there are non-critical, contractible qualities whose price is not known by the procurer, the flexibility finds the best value between the lowest price and lowest quality and highest price and highest quality. However, if it is critical importance to reach a minimum quality, or the price of the quality is known, it is better to use

first-price auction with minimum threshold for quality. The downside of the flexibility of a scoring auction is that the final price and quality levels are not known ex ante. (Bergman & Lundberg, 2013)

2.2.3 Endogenous entry and entry costs

As our objective is to study the effects of bid evaluation rule to entry, a short summary into modelling endogenous entry while entry costs exist is needed. Different models on endogenous entry show us how bidders may be making their decision to enter. In all these entry models and this thesis, we assume that there is pool of potential bidders who are making the decision to enter and pay the entry costs. The word endogenous refers here to the fact that each bidder's decision to enter depends on the decisions of other potential bidders to enter.

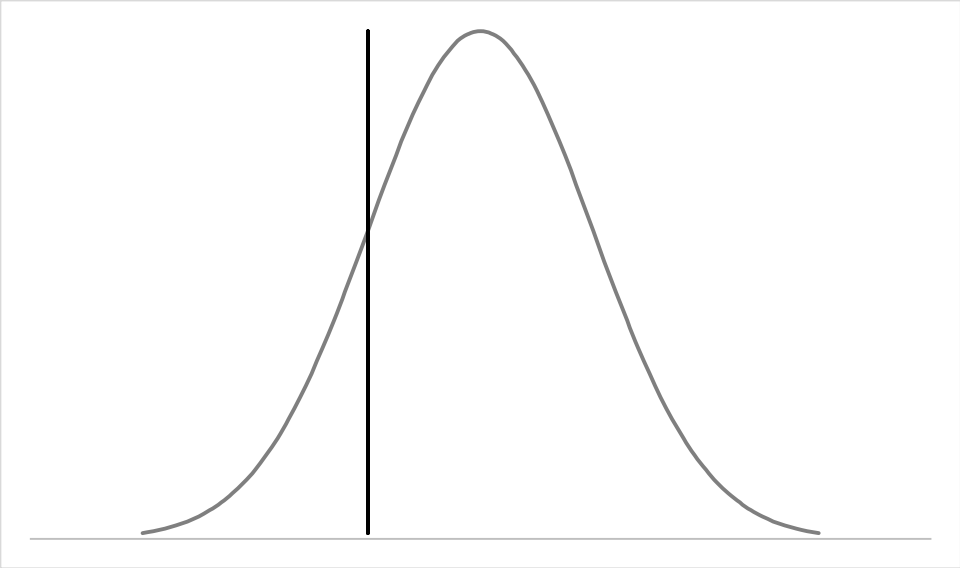
Assumption about private information is fundamental for the endogenous entry models with entry costs. In the two extremes, on the one side there are models where bidders have no uncertainty about their private costs, and on the other side there are models where bidders don't know their costs before paying the entry cost.

The model where bidders have perfect information about their costs before deciding to enter when entry cost exists is made known, among others by Samuelson (Samuelson, 1985). In his model, the decision to enter is simply based on the cut-off cost c^*. All bidders with lower cost will bid, and all bidders with higher cost will not. Formally, this profit function for a bidder with cut-off costs is represented in equation 1 just like introduced by Samuelson (Samuelson, 1985). The letter b is the bid, c is the cost, c^* is the cutoff costs, F(c) is the cost distribution, n is the amount of potential bidders deciding to participate, and finally, k is the entry cost that all participants have to pay. In the equation, the first term $b_0 - c^*$ represents the profit the marginal bidder would get by bidding the highest acceptable bid (because marginal bidder only wins if no other bidder participates). The second term is the change of being the lowest cost bidder, and therefore the winner. Together the two terms are expected value before entry costs. For a bidder whose costs equals the cutoff cost, the expected value equals entry cost, and therefore the expected profit is zero. FIGURE 1 demonstrates this visually. The grey curve represents the probability distribution function F(c), and the black vertical line represents the cut-off cost c^*. All bidders on the left side of the cut-off line will decide to participate in this model, and all bidders on the right side of the line will decide not to participate. We can see from the equation 1 that increase in the profit term will move the vertical line to the right, thus

increasing the chance of entry per one bidder. Increase in the number of actual bidders n will decrease the chance for winning, moving the cut-off to the left and decreasing the change of participating for one bidder. The entry cost k will also move the cut-off line to the left, therefore decreasing the change of entry for a single bidder.

$$[b_0 - c^*][1 - F(c^*)]^{n-1} - k = 0 \quad (1)$$

FIGURE 1: Normalized cost distribution and cut-off cost



One important finding made by Samuelson (1985) is that in his model the increase in the pool of potential bidders N will increase the number of actual bidders n, and the effect of N to social cost is ambiguous. This means that potentially, in this given context, the number of potential bidders may not matter to the procurement costs and social costs.

Another model, where symmetric bidders only learn their cost *after* they have made the decision to enter the auction, was made known for example by Levin & Smith (1994). In their model, entry cost represents the information acquisition, learning own cost. Unlike in the Samuelson model where a single parameter defines which bidders will enter, in the Levin & Smith modelling of endogenous entry all bidders will always have the same probability to bid because they are fully symmetric and don't have cost signals before deciding to enter. Instead, in this model there exists optimal actual bidders n^* that will influence each bidder's decision to bid. Equation 2 shows formally the profit function around the optimal actual bidders for a bidder who decides to enter the auction. In the equation π is profit, n^* optimal entry, and m is

the auction mechanism as a whole including the information acquisition cost of learning own cost. Each bidder knows that for the given auction mechanism there exists maximum number of actual bidders n^*, that would still mean that the expected profit for each bidder is at least not negative. Knowing this, each bidder forms a mixed-strategy for entering. Each bidder enters with a probability q, where $q = \frac{n^*}{N}$, and doesn't enter with probability $(1 - q)$. From this we can see that a single bidder is less likely to bid the more there are potential entrants, and more likely to bid the more there is potential profit available. Higher entry cost will reduce the profit and lead to lower probability for a single bidder to participate, and if holding N constant, it will lead to lower average of number of actual bidders. Also, any change in auction mechanism that reduced the profit, will lead to lower average number of bids.

$$E[\pi|n^*, m] \geq 0 > E[\pi|n^* + 1, m] \quad (2)$$

In this model, from the mixed-strategy equilibrium follows that the realized number of actual bidders will always vary between 0 and N. This means that increase in the number of potential bidders will increase the variation in actual bidders and lead to an increased probability of extreme cases of very low n or very high n. The social costs are higher the further away from the n^* the actual n is, meaning that the increase in potential bidders will increase social costs. This cost element is called either a coordination cost or entry effect, depending on the author. Levin & Smith (Levin & Smith, 1994) model also shows how with their assumptions, the coordination cost is worse the higher the information acquisition cost is. This would imply that more complex projects where costs are hard to evaluate are especially prone to the coordination costs. Furthermore Levin & Smith show that a limiting number of actual bidders n is socially beneficial when common costs apply.

2.3 Potential mechanism for how bid evaluation rule can affect the entry

We learned previously that all changes that increase potential profitability of winning a procurement contract will increase the entry, and that all changes that increase the entry costs will deter entry. This chapter discusses the potential mechanisms with more detail and more practically oriented way.

2.3.1 Entry cost

One way the bid evaluation can affect the number of actual bidders is simply by changing the entry cost. I have shown earlier that in both entry models, independently from the cost information uncertainty, an increase in entry cost will have a negative impact on the actual number of bidders. If cost uncertainty exists, the information acquisition costs may be higher in scoring auction than in a lowest price auction. Perhaps learning about both fixed cost and marginal cost of each quality dimension is more costly than only learning the cost for fixed-quality project. On the other hand, if uncertainty doesn't exist, preparing an offer for a scoring auction can be more burdensome than preparing an offer for a lowest price auction. The data offers some support for this; there are more so-called criteria lines in scoring auctions than in lowest-price auctions. A bit simplified, criteria lines are requests for quality and price inputs and often evidence to prove it. Again simplified, each line represents a single request. Thus, the more a procurement has these lines, the more evidence the bidder has to send to the procurer. Based on this evidence, it is possible that bid preparations are higher for scoring auctions.

2.3.2 Changes in information rents and profitability of winning

We have learned earlier that scoring auctions have tendency to overvalue quality that is imposed by higher procurement costs and higher quality. This overweight in quality exists because in multidimensional auction the bidders have private information about their fixed costs and the cost of extra unit of quality. This will increase the information rent bidders receive. This implies that ceteris paribus, winning a scoring auction competition can be more profitable than winning a lowest-price competition. As we know, this will have a positive effect on each potential bidder's probability to participate, thus increasing the number of actual bidders.

2.3.3 Favoritism

In scoring auction, the scoring rule is an explicit way to show bid preference by tilting the award rule to a non-price direction. Therefore, the possibility that scoring auction is used, by at least some procurers, to favor certain type of bidders. The procurement law has elements that aim to make the procurements competitions fair, but it is unclear how those laws are interpreted on the field. Of course we must keep in mind that favoring can only be a potential mechanism if the two bid evaluation rules differ in how they can be used to favor certain type of suppliers. Also, it is not shown here which groups would be favored. The kind of favoritism of in-house units in order to improve local employment that is shown by Hyytinen et al. (2018) is unlikely a concern in the Finnish context, where procurers have more power to directly favor in-house units without having to go through official public procurement process. Speculatively, procurers may want to favor local firms with the same employment improving motive. Data supports this argument weakly and anecdotally. I created two groups out of active bidders, one that showed clear preference for price-only auctions and another that showed clear preference for scoring auctions. The ones that seemed to prefer scoring auctions were more likely to be small or medium size local or regional suppliers, whereas those who seemed to prefer lowest-price auctions were more often larger and not local or regional suppliers. This evidence may suggest that small and medium size local or regional bidders were preferring the procurements with a scoring auction, because those procurements were more likely designed to be favorable to them.

The effect of favoritism, or bid-preference as it is often called, for participation when entry is endogenous and entry costs exists is studied among others by Krasnokutskaya and Seim (2011). Authors show that bid-preference affects participation of favored and non-favored bidders. Non-favored may be discouraged to enter, meanwhile favored will participate more often. However, the total effect on entry is ambiguous and could go either way.

2.3.4 Buyer's discretion and reputation

While skimming through the tens of thousands of different scoring rules, I noticed that use of different reputation- and experience-based scoring rules were relatively common[4]. This raises a question, just like with the favoritism, that perhaps scoring-auctions have better tools for using buyer's discretion than price-only auctions. Again just a speculation, but it has to at

[4] Scoring rules were often giving points for the experience of the responsible engineer or for showing references about similar projects.

least to be considered that while setting a minimum experience limit or threshold for reputation for a lowest-price auction can be seen as setting up barriers for entry, using scoring rules to encourage experienced and well-reputable bidders to participate may be more likely to be allowed.

Experience and reputation are different from other scoring rules such as time incentives, because potentially they treat incumbents and new entrants differently. The common sense would argue that using reputation in scoring may set barriers for entry for new entrants. For example, Shapiro (1983) discusses the potential implications of using reputation in auctions that leads to barriers to the entry. But even Shapiro ends up arguing that rewarding reputation doesn't need to lead to deterring new entrants. Spagnolo, after publishing multiple studies about reputation mechanisms in public procurement, speaks for the benefits of reputation mechanisms in procurements that have a lot of non-contractible quality, such as construction contracts (Spagnolo, 2012). Author argues, just as Shapiro did, that reputation mechanisms do not necessary deter the entry. According to him, the entry deterring effect depends on the treatment of potential new entrants. If new entrants are not penalized compared to proven incumbents, the author's evidence from test run in laboratory environment would suggest the entry is unaffected by the addition of reputation mechanism.

Based on this evidence, we can expect that potential higher use of reputation mechanisms in scoring auction may lead to either lower entry, or unaffected entry, depending on how the new entrants are treated. As long as suppliers that haven't participated in public procurement competitions before can access high quality, experienced labor, and can use contracts from private sector as a suitable reference, there is no clear disadvantage.

3 Public procurement in Finland

Finnish public procurement practices are directed by the Act on Public Procurement and Concession Contracts that is based on EU directives. Before 2017 procurers followed the older version (348/2007) and since 2017 they followed the newer one (1397/2016). These rules apply to all non-minor procurements. The threshold for construction works was 150 000€. All construction procurements above the threshold value had to organize formal public procurement competitions. Further regulation also applied to all procurements that exceeded the EU threshold, that was for construction procurements 5 278 000 euros before 2017 and 5 186 000 euros since 2017.

There is a special element to the Finnish procurement law that allows procurement without official process from in-house units for municipalities. Municipalities can make direct purchases from in-house units without organizing a formal competition even if the value of purchase is higher than the threshold value. In-house units can be private companies as long as municipality has at least partial ownership and influence on the decision making in the company. Access to private markets for these companies is limited because of concerns about fair competition. [5]

The public procurement process starts with the procurer publishing a call for tender document. Document contains information about what is procured, when the competition starts, and what kind of conditions apply. A call for tender document also states the rules for the competitive phase, including the bid evaluation rule in majority of the cases. The document is published in website HILMA[6]. Any potential supplier can access the document by completing a free of charge registration. Next follows the competitive phase where suppliers give their offers to the procurer. Giving offers includes the actual offered quality and price but usually also evidence to support that they can offer what they promise. After competitive phase finishes, procurer screens the bids and bidders and rejects them if needed. Finally, the valid bids are ranked according to the rules given in the call for tender, and winner is granted the contract.

4 Data

4.1 Datasets

The main data source provided by procurement consultancy firm Cloudia Oy to Aalto University contains information about calls for tenders, received bids, and to certain degree includes the winners of each procurement. Every line or field and its value was entered to the electronic procurement platform by the procurer or the bidder. Based on the structure of the data, we can assume that the data was collected to ensure the functionalities of their offered software services, and less for research purposes. Nevertheless, the data is quite comprehensive and includes data points from every stage of the procurement process from the call for tender to contracts that extend the original contract. The use of Cloudia's electronic procurement platform was gradually accepted as the main procurement channel for municipal and

[5] For longer explanation see article published by YLE https://yle.fi/uutiset/3-9386566 Accessed 2.6.2021
[6] Source https://www.hankintailmoitukset.fi/fi/ Accessed 31.5.2021

governmental organizations in Finland during the data's timespan from 2010 to 2017[7]. Because of the slow adaptation, the data is unbalanced panel data. Although the data contains all types of procurements, the analysis of this study focuses solely on the construction works procured by municipal or regional public authorities. More general analysis using the same data but including all types of procurements is done by Tukiainen and Jääskeläinen (2019).

In order to identify and categorize the type of procurements, I have linked the Cloudia's raw data with the publicly available data from public procurement portal Hilma[8] that is administrated by Ministry of Economic Affairs and Employment of Finland. Hilma Data[9] has basic information about each call for tender and includes a CPV-code (Common Procurement Vocabulary) for each procurement. CPV-classification is a unified procurement classification language created by European Union for the procurers to better communicate the subject matter of the call for tender to the potential suppliers. All procurements with a 45 as first two digits, referring to construction works, are included in the analysis. I also use the CPV-code as a control for the otherwise unobservable differences between different types of construction works.

Cloudia's data includes identifications for both procurer and bidder organizations but lacks the address data and the information about the location of the construction sites. I have extended the Cloudia's dataset by adding location information, city and region, for both procurer and bidder organizations. First, I have used Fonecta's publicly available site [10] to collect zip codes for procurers' and bidders' headquarters. Then I have merged that data with also publicly available data from Finnish government-owned post office Posti Group oy, that assigns each zip code to its respective city and region. The additional use of Posti's data ensures the integrity of the location data.[11] The combined result allows me to control the regional differences in unobserved procurement habits and in market structure, and take into account the distance-factor that plays a role in bidding decisions. For the lack of suitable and available data about the addresses of the construction sites, the location of the procurer is used instead. For procuring municipalities this is expected to be reasonable accurate proxy for a location, as the construction site can be expected to be in the same city. However, for the

[7] Data extends to October 2017

[8] www.hankintailmoitukset.fi

[9] Työ- ja elinkeinoministeriö: Työ- ja elinkeinoministeriön julkisten hankintojen ilmoitustilastoaineisto 2019 [sähköinen tietoaineisto]. Versio 1.0 (2020-02-04). Yhteiskuntatieteellinen tietoarkisto [jakaja]. http://urn.fi/urn:nbn:fi:fsd:T-FSD3413

[10] finder.fi

[11] Fonecta's naming conventions for cities and regions is not known, and my worry is that varying naming conventions would lead to less accurate data.

regional procurements this approach is less suitable, as the constructions site's location can be identified only on the regional level, not on the city level.

4.2 Limitations of the data

The obvious disadvantage of the used data is the lack of exogeneous shocks that would have changed the procurers' choice of bid evaluation rule. During the interval there was no clear policy changes that would be relevant to the bid evaluation rules. This fact separates this study from studies such as Hyytinen et al. (2018) in which authors measure the change in public procurement before and after a clear policy change.

Another limitation of the main data source relates to accuracy in controlling the project type and available observations. Typical empirical studies on public procurement practices use well defined and reasonably homogenic group of projects, such as cleaning contracts in Hyytinen et al. (2018) and have available data to control the most important differences in the projects such as Tadelis (2012). In the data set used in this paper, the project heterogeneity can only be controlled by using the engineer's estimates about the value and CPV-codes for the type of construction project. However, the accuracy of CPV-classification is less specific in the data is and not necessarily sufficient to control the heterogeneity between the projects.

4.3 Variables

4.3.1 Dependent variable

There are two alternative dependent variables that will complement each other in the analysis: the first is simply the amount of offers the procurement had received, called *offers*, and the other one is a percentage of observations receiving the number of offers that is below a critical threshold, called *failure*. When the data is analyzed from the point of view of received offers, we can ask questions like "Which type of bid evaluation design received more offers?" and "Is it possible that suppliers eagerness to bid is affected by the bid evaluation design?". When the data is approached from the point of view of variable *failure*, the questions are more focused on the premise that public procurements are failing relatively often, such as: "Is there evidence that the choice of a bid evaluation rule could be associated with an increase or decrease in the likelihood of the critically bad outcomes?"

The number of offers is retrieved from the main data set that was collected by Cloudia Oy. In the dataset, data is collected about responses made to the call for tenders. Any response a bidder makes may or may not comply with the rules of the procurement. I have only included those offers that are marked in the data as accepted offers; the unaccepted offers are not tracked. I have also made sure that the variable *offers* reflects the offers made by distinctive bidders, multiple offers made by the same bidder are counted only as one offer. This should make sense since we are expecting the procurers want multiple bids in order to increase the pressure for competition and leading to better outcomes, which the same bidder bidding twice doesn't provide. Also, I have cleaned the data from procurements that were in an ambiguous state, which means the data only covers those procurements that were marked as closed and saved into archives. Among the procurement status that were removed from the data were ongoing, unfinished, cancelled, and undefined status. Removal of the ambiguous state procurements raises questions if they had ambiguous status because they were failing or was the reason for the ambiguous status code independent of the expected end result. Huge majority of the removed procurements did not register a single offer. However, because the true reason for the assignment of the status codes is not apparent from the data, it is safer to assume that the procurers' single decisions like the choice of the bid evaluation rule were probably not the cause of the ambiguous status. In total, 468 procurements were removed because of the ambiguous status code. The data that is used now includes only those procurements that we can fully expect to have gone through the whole procurement process from the beginning to an end.

Variable *failure* gets value 1 if the procurement received less than critical number of offers, and value 0 otherwise. This allows us to measure the impact in different parts of the number of offers distribution.

4.3.2 Procurement rules

In the process of designing the procurement, the procurer makes certain choices considering the basic rule set on which the procurement competition is then based on. These rules can potentially have an impact on the desirability of the competition or change the competitive dynamics in a way that affects the amount of offers the competition receives, which in turn impacts the outcome of the procurement. In a real-life procurement, the framework for the competition consists of large number of rules. In this setting, there are three rules that have potential to have major impact: bid evaluation rule, entry rule, and sub-category bidding rule.

Many of the options for the rules are limited by the law of public procurement, but many options are also left for the procurer to make.

These decisions consider three dimensions of a procurement competition i) the choice of the offer evaluation criteria ii) Rules considering entry to the competition iii) partial bids and contracts awarded or not. The choice of the bid evaluation rule is the treatment effect in this thesis.

Bid evaluation rule defines how the winning bid is determined. The two major options for how the bids can be evaluated and ranked, are price-only evaluation and price and quality evaluation. A competition with lowest-price bid evaluation works like a sealed bid first-price auction. Bidders submit their bids, and the bidder who makes the lowest bid wins. The procurer pays the winner a sum equal to the winning bid.

A competition that is based on price and quality is called a scoring auction. The difference of scoring auction relative to the lowest-price auction is that in scoring auction the evaluation of the bids is two- or multidimensional. Offers have to include a response to each factor, called criteria, that is then scored. One of the criteria is price, others can include various qualities of the offered service including delivery time, experience, or improvements to the end product. Each of the evaluated factors receive a point score after which the total score is calculated according to scoring function and the bid with the highest total point score wins[12]. The procurer pays the winner according to the winning bid's offered price.

When procurers enter their call for tenders to HILMA electronic platform, they disclose which evaluation rule the procurement competition will use. Bid evaluation is among a few things that are publicly visible in the HILMA without having to register. The most common choice for bid evaluation rule is the lowest price with 80% of the procurements using it. The scoring auction was used in 19 out of 20 leftover percentage points, and the rest was using the evaluation rule that doesn't fit to either of the other two categories. For the choice about the bid evaluation rule, the most procurers choose between the lowest-price auction which is pure price evaluation, or the scoring auction which evaluates both price and quality.

The function of entry rule is to tell potential bidders which of them are qualified to bid. If the procurement competition has *restricted entry*, the potential suppliers must receive an invitation from the procurer in order to be qualified to submit a bid. All potential suppliers can ask the procurer to be invited, but the decision is done by procurer. If the procurement has *free*

[12] Can also be the lowest total score, depending on the actual scoring function used. Sometimes the total score is counted by subtracting the total quality score from the price, in which case the lowest total score wins.

entry, anyone is free to submit a bid without invitation[13]. There is also possibility to choose *negotiation*[14], which is its own procurement design, but the use of it is restricted by the procurement law and there are very few cases in the analyzed data.

The entry rule is also among the basic information that is public in HILMA. *Free entry* is used in large majority of the procurements in the data. It is used in 96% of the procurements, meanwhile only 4% are using *restricted entry*. *Negotiations* are used in less than half percent of the procurements.

For the entry restrictions, procurer chooses between free entry, that allows open bidding without pre-bidding screening of suppliers, and restricted entry in which suppliers need a permission to bid, in order to participate and enter a bid. Variable *free_entry* describes the former model and *restricted_entry* the latter. In the case of restricted entry is chosen, supplier needs to invite at least five potential suppliers, except if there are less potential suppliers in the market. The third variable in this rule dimension is *negotiations* that describes a kind of competitive beauty contest model, where at least three potential suppliers are invited to participate and bid. Third variable in this class is *negotiations*, describing the procurements that used negotiation-based model instead of competitive bidding-based model. Arguably, the negotiation should be one of the evaluation rules. However, in the data, field for negotiations is put together with the entry-rules, meaning that in the electronic form for the call for tender, the procurer can choose between these options. It should also be noted that negotiation-based model could still have competitive elements in it. The negotiation-based model can be seen as one type of entry restriction.

The last design choice is related to the treatment of sub-category bidding. If the procurer allows sub-category bidding, bidders are allowed to submit offers for one or more sub-categories without having to bid for the project as a whole. You can think of allowing sub-category bidding as asking offers for a plumbing, electricity and painting so that it doesn't matter for the procurer if all three categories are won by one and the same bidder, or if all three categories are won by different bidder. If sub-category bidding is not allowed, each of the bidders is supposed to submit their offers for all the sub-categories, and the lowest total price or highest total score wins. Think of this as asking offers for the three categories but needing one supplier to take responsibility of all three tasks.

[13] Everyone is free to bid, but procurement law states certain conditions the bidder must fill in order to be qualified bidder. But these conditions are not restrictive for healthy companies that follow the laws.

[14] Negotiation in this context refers to a setting where procurer discusses with hand-picked suppliers about the best implementation of the procured service or good. Evaluation of the offers is always two – or multidimensional in negotiations. Negotiation may or may not include a competitive bidding phase.

Sub-category bidding is one of those rules that are included in basic information in HILMA. 9 % of the procurements in the data allowed sub-category bidding.

4.3.3 Control variables

There are certain monetary thresholds that change the requirements for the procurement. Act on Public Procurement and Concession Contracts apply only to public procurements of construction projects that are over 150 000 €[15] in value. Public organizations don't have to organize competitive and public procurement processes for contract procurements below the threshold. However, all procurements included in the analysis were published for public and were using competitive procurement design, even if their engineer's estimate was lower than 150 000 €.

Second threshold defines, if the procurement must follow national procurement protocol or EU-procurement protocol. This EU-threshold is 5 278 000 €. Procurements of construction projects between 150 000€ and 5 278 000 € follow national protocol, and procurements exceeding the value 5 278 000 € will follow EU protocol.[16] In general, the difference between a national procurement and an EU procurement is that the rules for EU-procurements are more specific, and guide the procurement process more strictly. It is also possible that EU-procurements are published in a different platform than national procurements.[17] Anyway, the data is not guaranteed to include procurements or offers that were submitted through other channels than HILMA.

Just like there are procurement that are procured like a national procurement even if their value is below the threshold, there are also procurements under the EU-threshold that are procured as a EU-procurement. The required document is different for national and EU-procurements. In the data, we can identify national and EU-procurements by the type of the submitted call for tender document. All procurements in the data are either national or EU procurements. In the data, 7% of the procurements were EU-procurements and rest were national procurements.

When a representative of a potential bidder finds an interesting call for tender from HILMA platform, and clicks a link to receive more information, the platform requires a

[15] For non-contruction project services the threshold was 30 000 € until 2017 and 60 000 € in 2017.
[16] Threshold 5 186 000 € in 2017. For non-contruction project services the threshold was 137 000 € until 2017 and 134 000 € in 2017.
[17] Although since the start of 2017, procurers were required to publish call for tenders in HILMA even if they were EU-procurements.

registration. The representative registers with the bidder organizations credentials. The data I am using includes information about these registrations which allows us to count how many potential suppliers were interested about the project. The registration is free of charge and we can expect it has no costs to the potential supplier. The amount of interested suppliers is measured with the variable *registrations*. This is used as a proxy to control the differences in market size between the procurement.

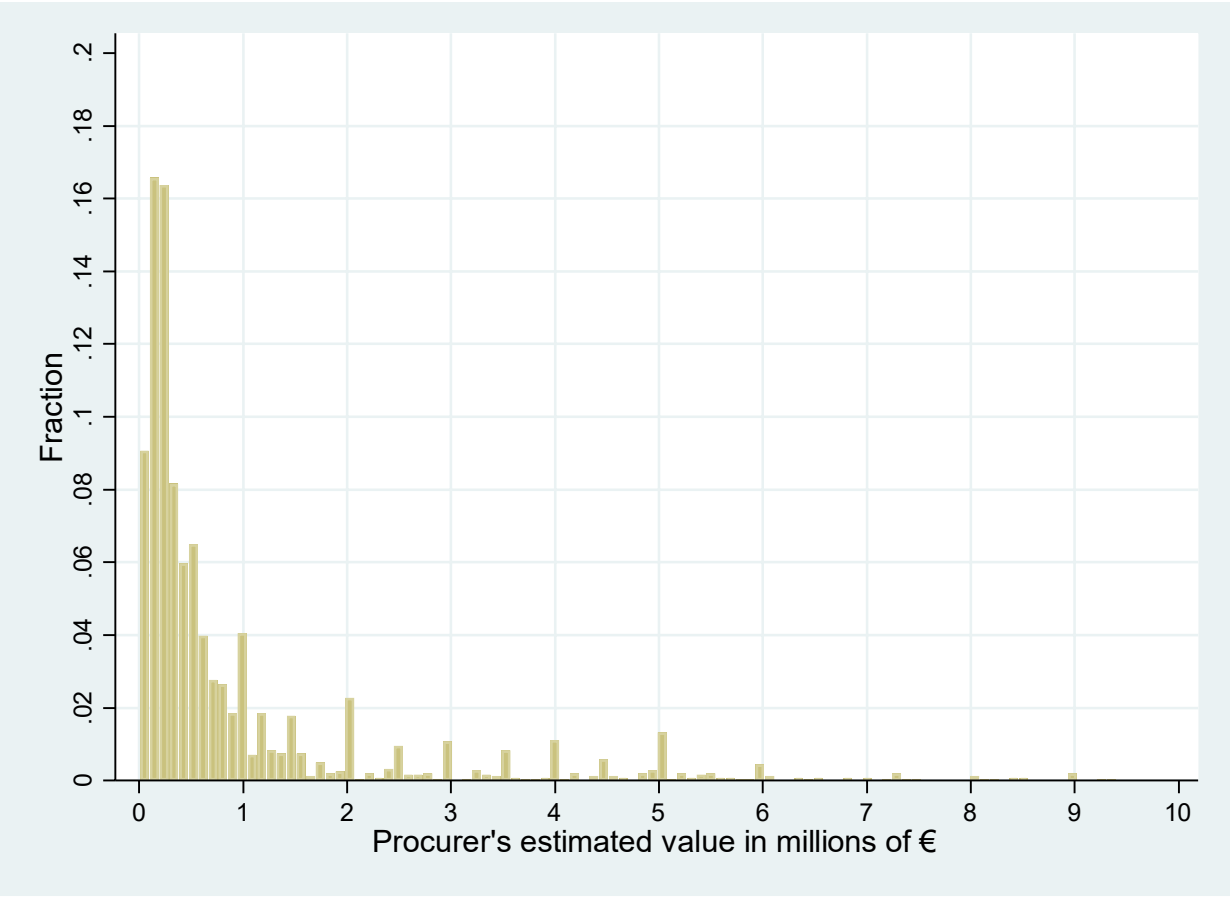
Procurements seemed to receive more than 4 times more registrations than distinct offers on average. The amount of registrations varied between 1 and 153, the average being 22.80. This means that only a bit more than one in five of the registered suppliers ended up submitting a bid.

In the call for tender document filled by the procurer, there is a field for the engineer's estimation of the value of the project. Most common way of presenting the engineer's estimate is to give two numbers, as a range, but there are also estimates with one figure only. In case the estimate is given as a range, I have chosen the larger number to represent the engineer's estimate.[18] I expect that the estimate is not used as a binding threshold for minimum or maximum price, but to communicate the expected scale of the project to the potential bidders. This *engineer's estimate* is among the basic information that is publicly available without registration.

The distribution of the engineer's estimated of the construction projects is strongly skewed to the right. As large fraction of the procurements were surprisingly small in value for construction projects, the tail of the engineer's estimate is long towards the right. As the Picture A below demonstrates, perhaps surprisingly, 80% of the projects were one million euros or less in estimated value, the most common size of a procurement being between hundred thousand and three hundred thousand euros. The mean of the engineer's estimate is 0.94 M€ and median 0.35 m€, also demonstrating the skewness. The picture also shows that large estimates are rounded to the closest quarter, half, or full million, thus the larger columns at 1, 2, 3, 4, and 5 million. This rounding demonstrates how noisy some of estimates are. There are also 12 procurements with estimated value over 10 € that were omitted from the picture. The highest value in the used data was 45 M€.

[18] My educated guess about the decision process is that procurers are cautious to set a high anchor price for the bidders, thus when giving a range, procurers may be inclined to present the minimum as a hopeful estimate and hesitant set maximum higher than they expect to end up paying for. Following this logic, the higher of the two is better estimate than lower or even the average of the two.

FIGURE 2: Histogram for engineer's estimated values in millions of euros



Notes: Each bar's width is 100 000 euros. Observations over 10 million euros are excluded.

4.3.4 Project type, regions, procurers and years

The construction project types are identified and divided to categories by using the CPV-codes, declared in the call for tender document by the procurer. In a nutshell, CPV-classification (Common Procurement Vocabulary) is a unified procurement classification language created by European Union for procurers to better communicate the subject matter of the call for tender to the potential suppliers. It consists of the main vocabulary and the supplementary vocabulary, but in this paper, only the main vocabulary is used. The main vocabulary is 8-digit tree structure. The first two digits are the divisions, the first 3 digits are the groups, the first 4 are the classes and the first 5 are the categories. The more digits are used, the more specific and accurate the classification is. In the data, almost half of the procurements only have the two first digits, thus those projects can only be identified as construction projects and more accurate identification is not possible. On the other side of the accuracy spectrum available is the 4-digit classification that was the most accurate still relatively commonly used in the data. But already at the 4-digit accuracy level, the observations are in dozens, not in

hundreds, making the analysis based on very specific categorization difficult. For the use of this thesis, 3-digit accuracy is used in identification of the different project types. Using the 3-digits, we can divide the projects to six groups as in the *TABLE 1* below. The occurrence of the types is not even in the data. The codes 450 (49%), 452 (35%), and 453 (9%) are relatively commonly used, in contrast to codes 451 (4%), 454 (2%), and 455 (2%), that are rarely used in the sample procurements.

In addition to the estimated value, the type of project is controlled and included in the model by dividing the contracts in to five different groups. The expectation is that projects of same size inside the contract type category are comparable enough for predictive analysis.

TABLE 1: Contruction project types

3-digit CPV-code	Description
451	Site preparation work
452	Works for complete or part construction and civil engineering work
453	Building installation work
454	Building completion
455	Hire of construction and civil engineering machinery and equipment with operator
450	Group-level specification missing

For the analysis of this paper, the type of work is controlled by making a dummy variable for each of the group classification, leaving the observations missing the group-level classification as a baseline.

There may be different reasons why some procurements are using 2-digit specification instead of three.[19] However, closer look on the data doesn't show any difference between the procurements with 2-digit code compared to the procurements with 3-digit code. In all observable variables procurements with code 450 are indifferent from all the others. Given this knowledge, code 450 seems to represent all the other types of projects in aggregate.

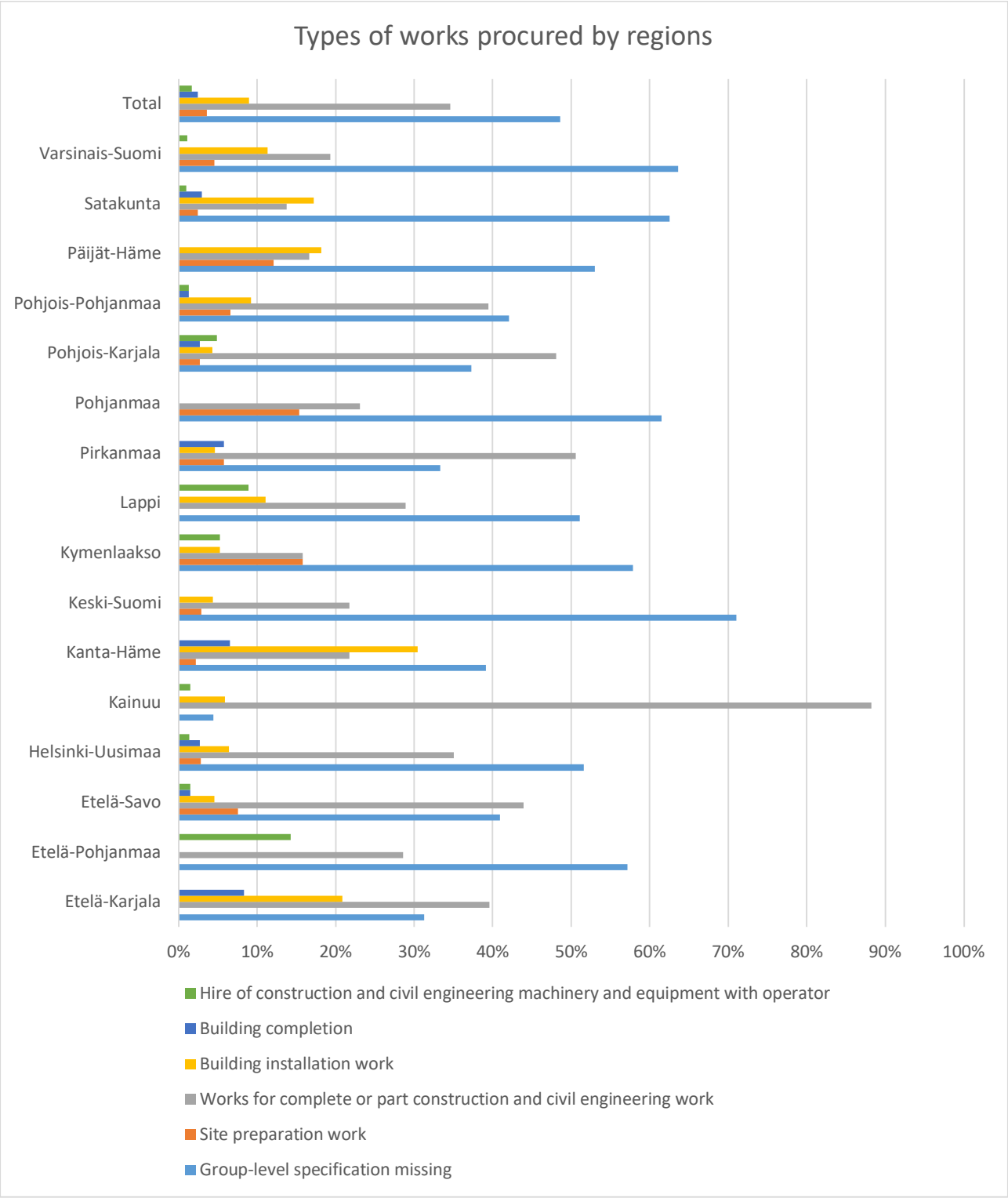
The data includes procurements from 16 different regions. The number of observations per region vary from seven in Etelä-Pohjanmaa to 736 in Helsinki-Uusimaa. The main dataset didn't have data about regions directly. To receive the region information for the procurement

[19] Educated guess was that procurers were trying to reach as many suppliers than possible by using the aggregate level code. However, analysis of the data shows no difference in registrations. Another guess was that the code 450 procurements were larger projects, but that is not supported by the data either.

organizations I have first used procurer organization names to receive a zip code information from publicly available data from Fonecta.[20] Then I have combined the data about zip codes with another publicly available data from Posti Group Oy, which allowed me to assign each zip code to a respective region. Each region in the data refers to the region the respective procurement organization had their headquarters in.

[20] finder.fi

FIGURE 3: Regions and types of construction works



Notes: Each bar represents the proportion of a type of construction works of all construction works in that region.

There are 82 procurer organizations in the sample. The amount of procurements by the procurers varies between one and 199. 14 procurers had only one procurements, 42 had more than ten, and four had more than hundred.

Even though the data includes observations from 2012 to 2017, it is not a balanced panel data, because it doesn't follow the same constant group of procurers throughout the time period. The procurer organizations started slowly adopting the use of the electronic platform one by one. Only in 2017 the use of the platform was made mandatory. Therefore, we can see that every year more and more new procurer organizations appear in the data each year. In 2012 there was only one procurer organization, in 2013 17 organizations and 2017 there were already 66 active procurer organizations. Similarly, there was only 2 procurements in the sample in 2012 but 581 in 2017.

There are a few arguments that imply that the use of yearly effects should be controlled. Most importantly, the macro-economic shocks are known to have great effect on investment good sector such as construction sector. These shocks, even if they didn't directly affect the budgets of the public sector organizations, change the value of the outside alternative for a potential bidder considering participation to a procurement competition. Positive macro-economic shocks are then expected to have negative effect on the number of offers received, and negative shocks are expected to have positive impact. Another factor that the yearly effect may catch is the potential impact of election cycles. Election cycles may have an impact on the number of offers if at the end of the election cycle the financial politics in the municipalities would be more expansive to improve local employment or start statement projects. The expansive politics would then cause a similar positive economic shock than positive macroeconomic shock. There would be less expected offers at the end of the election cycle because the demand would be higher.

Because of the unbalanced nature of the data, yearly effects are not offering insight or controlling for the mentioned shocks. And although the mean of number of offers did drop in 2016 and 2017 at the same time when construction sector was growing[21] and election cycle was approaching the end[22], there is another possible explanation for the decline in number of offers: The measured decline may be explained by the self-selected adoption of the electronic platform and the change in procurement law in 2017 that made it mandatory. When the adoption is self-selected, we expect that the procurer organizations who expect to benefit most

[21] Tilastokeskus Rakennusteollisuus data
[22] Municipal elections were hold in April 2017.

from the adoption will be the early movers, and in contrast, those organizations that adopted it in 2017 when it was mandatory, probably calculated earlier that the adoption has negative value for them, for one reason or another [23].

TABLE 2: Descriptive statistics

Variable	Definition	Mean	S.D.	Min	Max	Median	Obs
Dependent variables							
Received offers	Number of offers	4.84	4.32	0	75	4	1822
Critical failures %	1 if less than 2 offers, 0 else	0.13	0.34	0	1	0	1822
Procurement rules							
First-price auction	1 if lowest-price eval., 0 else	0.80	0.40	0	1	1	1822
Scoring auction	1 if scoring eval., 0 else	0.19	0.39	0	1	0	1822
Oth. bid evaluation	1 if any other eval., 0 else	0.01	0.09	0	1	0	1822
Free entry	1 if all free to bid, 0 else	0.96	0.20	0	1	1	1822
Restricted entry	1 if entry is restricted, 0 else	0.04	0.18	0	1	0	1822
Negotiations	1 if negotiation used, 0 else	0.00	0.07	0	1	0	1822
Sub-category bidding	1 if sub-categ. bids acc., 0 else	0.09	0.28	0	1	0	1822
Controls							
National procurement	1 if national proc., 0 else	0.93	0.25	0	1	1	1822
EU-procurement	1 if EU procurement, 0 else	0.07	0.25	0	1	0	1822
Registrations	Number of registrations	22.80	12.89	1	153	20.5	1822
Engineer's estimate	Procurer's est. value in M€	0.94	2.27	0.008	45	0.35	1765
Criteria lines	Number of criteria lines	8.08	28.69	0	465	1	1822
n:th procurement	No. of earlier proc. + 1	53.15	57.29	1	265	30	1822
LacksSmallWhenSmall	1 if lacks small bidders, 0 else	0.04	0.19	0	1	0	1822
LacksLargeWhenLarge	1 if lacks large bidders, 0 else	0.05	0.22	0	1	0	1822
Type of work							
Site preparations	1 if CPV3 = 451, 0 else	0.04	0.19	0	1	0	1822
Construc. and civil eng.	1 if CPV3 = 452, 0 else	0.35	0.48	0	1	0	1822
Building installation	1 if CPV3 = 453, 0 else	0.09	0.29	0	1	0	1822
Bulding completion	1 if CPV3 = 454, 0 else	0.02	0.16	0	1	0	1822
Hire of machin. and eq.	1 if CPV3 = 455, 0 else	0.02	0.13	0	1	0	1822
Unspec. Construc. work	1 if CPV3 = 450, 0 else	0.49	0.50	0	1	0	1822

Note: Engineer's estimate is availably for only 1765 out of 1822 observations.

[23] Reasons including the possible lack of the computer skills either in the procurement organization or among their potential suppliers. Recall that the beneficial use of the electronic platform requires that the procurer can submit the call for tender to the platform successfully, and that the potential bidders have to both find the call for tender among thousands of call for tenders and submit their offers in electronic format.

5 Identification Strategy and descriptive statistics

The objective of the empirical analysis is to measure the effect the bid evaluation design had on the number of offers received and to the effect of bid evaluation rule in the critical margins in public procurements in construction sector on a period from 2012 to 2017. The hypothesis is that the bid evaluation design can potentially change the incentives of the potential bidders by making the competition more lucrative to the potential suppliers. These changes are measured and analyzed in terms of how many offers from distinctive bidders the procurement competition received.

The bid evaluations rules used in the Finnish public procurements are divided to two major groups. There are procurements where bid evaluation is based on the price only. The competitive phase of these procurements is a first-price auction. Then there are procurements where bid evaluation can consider various quality measures in addition to price. In these procurements the competitive phase is a scoring auction.

In this empirical section we compare the performance of the two groups, based on the evaluation rule: first-price auction and scoring auction. Empirical models are build to control other factors as to separate the effect of the evaluation rule.

Difference in amount of received offers between the procurement using first-price auction type of bid evaluation and scoring auction type of bid evaluation would indicate a persistent effect. Scoring auction type of bid evaluation can negatively affect the potential bidders eagerness to bid because the scoring auction can have higher participation costs, as it takes extra effort to learn one's cost of additional quality in addition to learning the cost of the baseline service. Scoring auction as a multidimensional auction is more complex for the bidders. One argument on why scoring auctions may perform worse is that in scoring auctions the final outcome is harder to predict, thus making scoring auctions riskier and less lucrative prospect for potential suppliers. On the other side of the coin are the benefits of the scoring auction. The multidimensional nature of scoring auction decreases the pressure on competing with price, which has benefits in two cases. Lower pressure on price competition can be helpful in cases where abnormally low tenders are a concern, or in common value auctions where winner's curse is expected to deter bidders. In both cases, the lower marginal benefit of making a lower bid will reduce the possible harm, and in both cases more offers can be expected.

Other implications of using scoring auction are due to changes in buyer's discretion and favoritism. In first-price auction favoritism and discretion can be practiced by setting up

required standards that can make it more likely for the favored party to win. Examples of such standards could be a required certificates or minimum limit for the years of experience of the responsible engineer. Downside of this approach is that if the standards are too restrictive, they can be legally challenged. In scoring auctions, similar favoritism could be practiced by giving the certificates and experience quality points that are used in the scoring of the offers. In this way, the favored party can gain an advantage, but the approach is much harder to legally challenge. Similarly, it can be easier to use buyer's discretion for example to close the competitive gap in the situation where the market is very heterogeneous in terms of plain costs.[24] What the effect of this additional tool is, depends on the market dynamics. If the favored party was disadvantaged, the amount of offers may increase, if the probability of the favored party to bid increases more than other bidders' probability to bid decreases. If the favored party was already advantaged, the number of offers will decline, because other bidders see the competition less lucrative as their changes to win decreases.

Although the lack of consistent data about winning bids and post-contracting performance and quality dictates that the performance and success of the procurements are measured by the received offers, the approach has its merits.

Another objective of the empirical analysis is to try to find patterns in what kind of procurement attract more offers, and what seem to be the largest explaining factors for good or bad performance in terms of number of offers. This analysis hopefully will give some insight on the real life determination of the procurement auction outcome and works as a starting point for anyone interested of the inner-workings of real-life public procurement.

5.1 Identification

Selection into two groups is based on observables. A procurer selects the bid evaluation rule based on the observable characteristics available. Causal interpretation of the results requires that Conditional Independence Assumption is satisfied. Because, in these settings randomized control trial is not possible, the Conditional Independence Assumption holds only, if there are no unobserved factors that correlate with the treatment and affect the participation . To put it in the context; the causal interpretation is possible, if we can assume, that the procurers' decision to choose the bid evaluation rule was only affected by the same factors, that are measured and controlled in the models. Reader's discretion is strongly encouraged. But

[24] Given that supplier know their costs to certain extent and that the procurer knows about the heterogeneity.

even if arguments for causality are not in entirely solid grounds, the possible difference between the two bid evaluation rule would give food for thought for an economist thinking about the optimal procurement auctions that work in the real world, or policy makers who are concerned of the low turnout for public procurement auctions.

The number of offers n can be modeled simply as a number of potential bidders N multiplied by the participation rate r, as shown in equation 3.

$$n = N * r \tag{3}$$

We assume that market size N is constant for a single procurement in the short term and that procurer's behavior doesn't have an impact on the market. Thus, the only thing that is relevant is that what portion of the pool of potential bidders will choose to participate. The participation depends on the profit received if the contract is won, the change of winning the contract, and the cost of participation. However, none of these can be found from the data, so we have resorted to a different model. Equation 4 below is a way of modeling offers which is relevant to the chosen approach. In the equation 4 L_i is the vector of variables that affect the lucrativeness of the contract. N_i is the market size, and E is the entry or participation costs. In the model 1, in the table Y, the choice of the bid evaluation rule is the treatment and the only measure for lucrativeness, while the comparison group is the first price auction. The variable *registrations*, a proxy for market size, is the market factor. [25]

$$n_i = \beta_0 + \beta_2 L_i + \beta_3 N_i + \beta_4 E_i + \varepsilon_i \tag{4}$$

The mechanism through which the bid evaluation would affect the number of bidders is by changing the lucrativeness of the competition. The bid evaluation is separated from the other lucrativeness measures in model 5, where S means scoring auction, and L_i signifies other factors that affect the lucrativeness.

[25] Note that market size refers to the quantity of potential suppliers rather than the size of the project in euros, which would be the more conventional definition of market size.

$$n_i = \beta_0 + \beta_1 S_i + \beta_2 L_i + \beta_3 M_i + \beta_4 E_i + \varepsilon_i \quad (5)$$

As we have no way of measuring entry or participation costs, we have to leave it out of the equation. However, we can assume that the entry costs for two otherwise similar procurements are the same. Furthermore, the choice of the bid evaluation rule seems to impact the entry costs, for example, additional effort required to create an optimal bidding strategy in a scoring auction, but it is hard to see that the entry costs would have an impact on the choice of the bid evaluation rule. Endogeneity may be a problem if there are procurer traits that both lead to higher usage of the scoring auction and higher participation costs. This, however, can be controlled by running the model with procurer fixed effects.

Null hypothesis is that the choice between first-price auction that uses price only bid evaluation and scoring auction that uses price and quality measures in bid evaluation doesn't have impact on the lucrativeness of the competition. A procurement would receive same number of offers independently from the bid evaluation rule.

$$H_0: \beta_1 = 0 \quad (6)$$

5.2 Variables and descriptive statistics

5.2.1 Dependent variables

The goal is to compare the performance of the two groups, the procurements with lowest price evaluation and another multidimensional scoring evaluation, measured by offers received and percentage of critically bad outcomes. A persistent difference may be indicative of bid evaluation rule having an impact on the number of offers.

FIGURE 4 shows that the procurements with scoring auction received on average one more offer than those procurements relying on price-only evaluation. This shows that at least in aggregate there is difference between the groups. Histograms in FIGURE 5 show the distribution by the number of received offers and by the bid evaluation rule. We can see that the distribution of the scoring auctions is more skewed to the left, indicating that this type of auctions tends to receive a large number of offers more often than first-price auctions. We can

also see that scoring auctions got a zero offer outcome less often than first-price auctions, but the difference is small. In fact, TABLE 3, that shows the probability of the critically bad outcomes by the bid evaluation rule, shows that scoring auctions were just one percentage point less likely to have critically bad outcome.[26]

Procurers are mostly free to choose the bid evaluation rule[27]. We do not assume a fixed objective function for the procurer's decision. Instead, we can allow various objectives the procurers can have. I will discuss here what are the possible primary determinants of the objective function of the procurers. First, it is reasonable to assume that procurers want to avoid critical outcomes, where the primary objective of acquiring the wanted service fails. Let's assume two ways the procurement can fail to acquire the service: procurement can either fail because it receives zero viable offers, or because it fails to attract enough competition in a way that the winner is not seen to be selected competitively. Attracting enough competition is written as one of the requirements for a good public procurement competition practice. I have assumed for the sake of simplicity that a procurement that receives only one viable offer is seen as a failed competition, and two or more viable offers are seen as sufficient, but keeping in mind that that is not necessary true in reality. As well, it is sensible to assume that at least most procurers in most situations work under a limited budget and has incentives to minimize costs. Another objective of the procurer is to maximize the quality with the available budget. This is how Bergman and Lundberg (2013) see the objective function of the procurer. From this point of view, the procurer would aim to maximize quality with the given fixed budget. It is also possible that procurer thinks the opposite and tries to minimize the procurement costs while keeping the quality fixed. Now, from the two available evaluation rules, the first-price auction is good at minimizing costs while keeping quality constant, and the scoring auction is especially suitable when both quality and price are flexible. Scoring auction with fixed costs (a scoring auction where bidders only compete with quality) is good at maximizing costs while keeping the costs fixed. However, it is unclear if scoring auction with fixed quality was allowed before

[26] The same table also demonstrates a common pattern from data. Those procurements that were lacking relevant information such as the bid evaluation rule, were much more likely to have critically bad outcomes. However these procurements missing data are not included in the analysis of this paper, because there is no clarity about why they are missing data, and if perhaps those observations lacking data about bid evaluation rules were also lacking data about the number of received offers.

[27] There is one small limitation in choosing the bid evaluation rule. Since the start of 2017, a procurer that wished to use price-only evaluation in EU-wide procurement that was not procuring goods, must have provided a written justification.

2017, while the new procurement law specifically mentions and allows the use of fixed price scoring auction.[28]

FIGURE 4: Mean received offers by bid evaluation rule

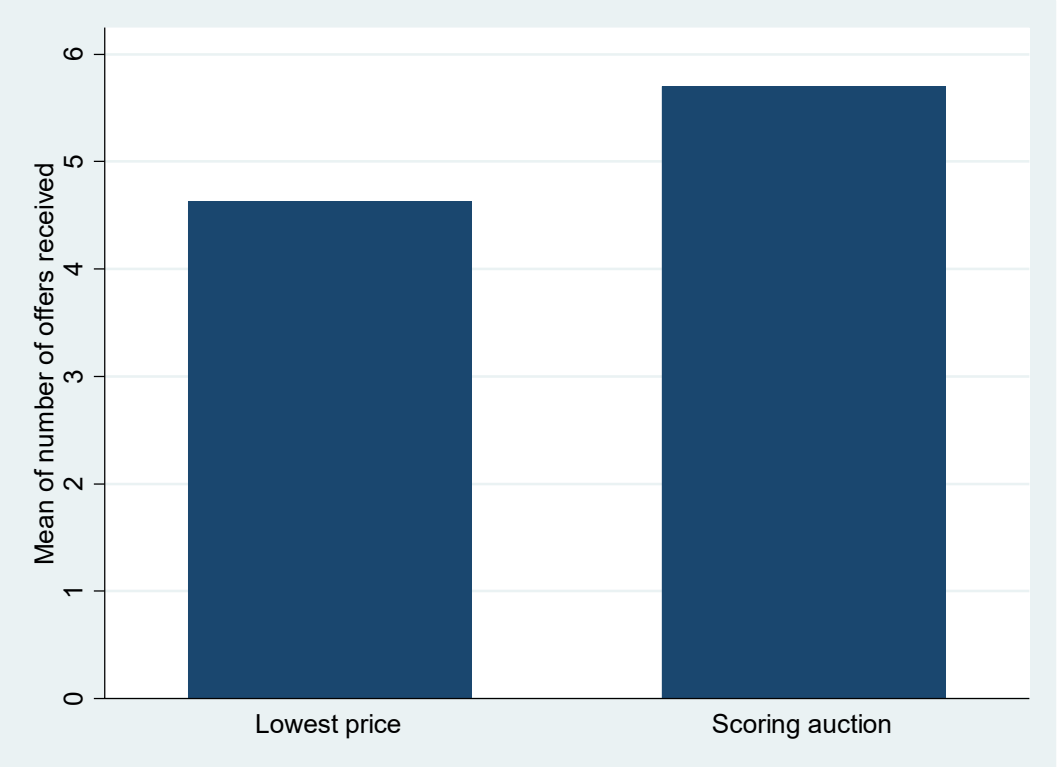


TABLE 3: Bid evaluation rules and proportion of critically bad entry outcomes

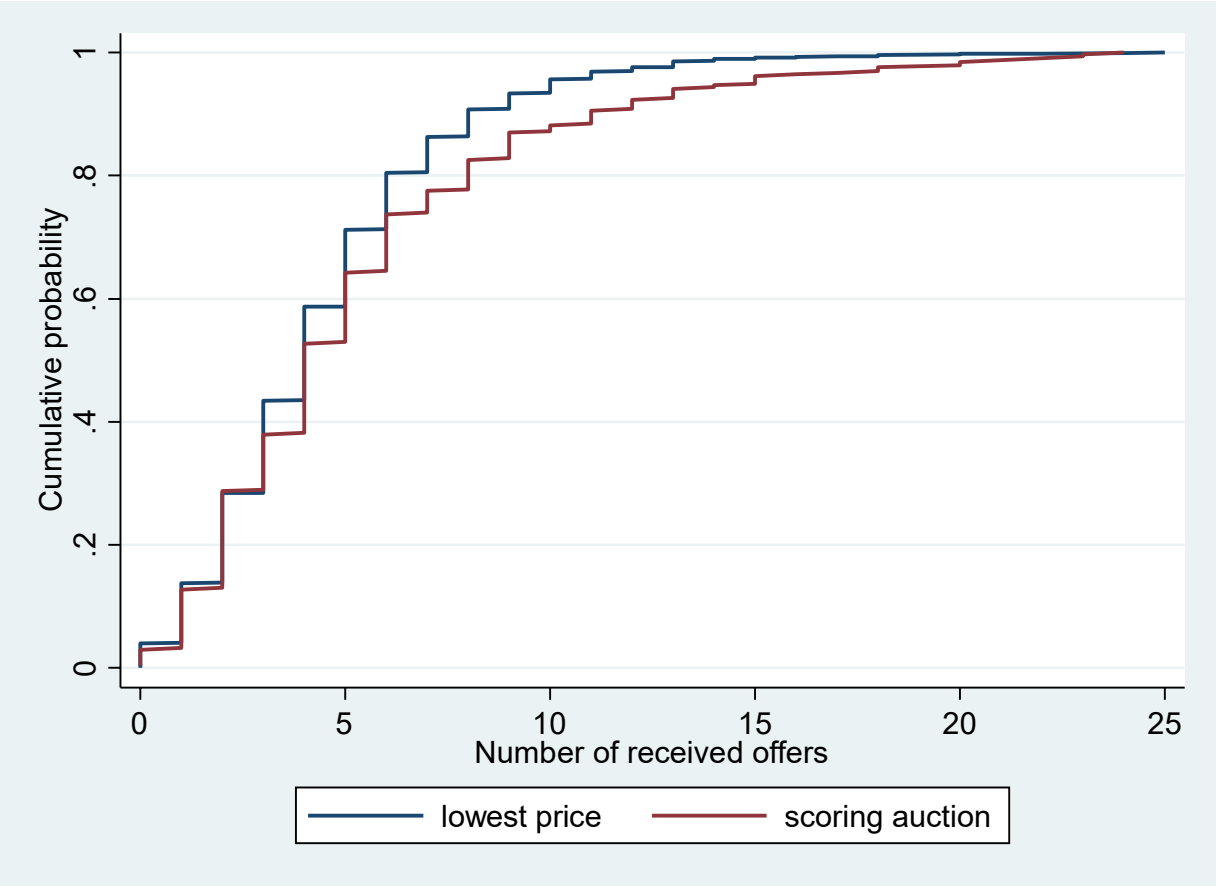
Auction rules	critical (n<2)*	Obs
First-price	0.14	1466
Scoring	0.13	342
Misc	0.07	14
Data missing	0.57	379
Total	0.21	2201

*Note: * Proportion of critical outcomes*

[28] Before 2017 the procurers had to choose either lowest-price offer or the most economically advantageous tender.

FIGURE 5: Histograms for number of received offers by bid evaluation rule

FIGURE 6: Cumulative distributions number of offers by bid evaluation rule



5.2.2 Other procurement rules

Another decision point in addition to the bid evaluation rule is the entry rule. The two major options are open entry, which means that all potential bidders are allowed to make bids without pre-screening, and restricted entry, which means that procurers can ask permission to enter the competition but finally only those bidders that received permission are allowed to make bids. In restricted entry design, procurer can pre-set a maximum limit for the number of participants. The minimum number of participants have to be five in the restricted section, although if can be shown that there are not enough viable candidates, less than five is accepted. Also in restricted entry competitions, the procurer has to pre-determine how the participants are to be chosen.

There are several potential reasons why procurer would want to restrict the entry. If there is high level uncertainty about the costs and high entry costs, the coordination costs can deter bidders, and therefore limiting the number of participants can actually increase the number of received offers. Similarly, the restricting the number pf participants is beneficial in theory if the auction is a common value auction. In a common value competition, the true value of the

project is the same (meaning the distribution where the bidders draw from is the same), but it is initially unknown. After deciding to bid, each bidder pays information acquisition costs and receives an imperfect estimate of the true value. In common value auction winner's curse exists. The bidder who receives the highest estimate for the true value of the project will win but risks of making deficit because the true value turned out to be lower than their estimate. Knowing about the winner's curse, participants are careful to participate and bid high (in procurement auctions). The more there are participants in the auction, the more potent is the winner's curse. Restricting the number of participants will in this case improve the procurement outcomes.

A restricted entry was commonly used in larger projects. The average size of the procurement using the restricted entry was 2.16 million euros compared to the data average of 0.94 million euros. The difference persists if we exclude the larger EU-wide procurements, after which the average size with the restricted entry was 1.35 million euros compared to the average of 0.73 million euros.

When sub-category bidding is allowed, suppliers are allowed to make bids to a single sub-category of the project and do not need to bid for the whole project. When sub-category bidding is not allowed, all of the bids are for the project as a whole and there is only one winning supplier. Sub-category bidding is expected to increase the number of offers by distinct bidders. Smaller bidders that didn't have the capacity or know-how to bid for the whole project, can bid for one or more sub-category if the sub-category bidding is allowed. Or similarly, if a supplier has a low costs signal for some of the sub-categories but a high cost signal for others, it may decide not to bid for the project as a whole, but would bid for the competitive sub-categories if it is allowed. The downside of accepting partial bids is that some of the bidders that would have bid for the whole project, may prefer to bid for only some of the sub-categories if it is allowed. There is also a possibility that not all sub-categories receive bids, which would lead to a partial failure of the procurement.

TABLE 4 demonstrates the correlation of the two bid evaluation rules with the usage of other rules. Table reveals that the sub-category was allowed more often in the procurements using a scoring auction than in procurements using a first-price auction. In fact, the use of sub-category bidding was almost three times as likely in the scoring auction as in the lowest-price auction. This correlation can help to explain why the scoring auction had longer right tale. As procurements with partial bidding accepted are much more likely to attract numerous different sized bidders. But it has to be remembered that the distinct bidders are less valuable in procurements with partial bidding, because the competition is not guaranteed to be even

between the sub-categories. Restricted entry was used more in the scoring auctions, but the difference is not as significant. In general, the use of restricted entry wasn't particularly common.

TABLE 4: Use of combinations of auction design rules proportionally and by bid evaluation rule

	Lowest Price		Scoring auction	
	Free entry	Restricted entry	Free entry	Restricted entry
Partial accepted	0.06	0.00	0.17	0.00
Partial not accepted	0.90	0.03	0.80	0.04

5.2.3 Controls

National and EU-wide procurements differ first and foremost in value, but also there are differences in the procurement law and differences in requirements in reporting. Most importantly, the procurement law in general is more detailed for EU-wide procurements. Initially I had expected that the EU-wide procurements would have performed worse than their national counterparts, first, because more rules would mean higher participation costs for the potential bidders, and secondly, because I expected the capacity constraints to limit the available potential suppliers[29]. But the data shows that the contrary is true, as EU-wide procurements received average number of offers of 7.25 compared to the average of 4.66 for the national procurements. Furthermore, EU-wide procurements failed critically only 3%, only four in total, whereas 14% of the national procurements were below the critical threshold. If we are to speculate why EU-procurements performed better, the probable reasons include larger project sizes, and more standardized and thus more predictable procurement protocol.

[29] Average size of and enterprise in the construction sector in Finland was around 1 million euros (41 000 enterprises with total turnover 40 000 M€), the number of enterprises quickly narrowing down to the top. Official Statistics of Finland (OSF): Structural business and financial statement statistics [e-publication]. ISSN=2342-6233. Helsinki: Statistics Finland [referred: 27.4.2021].
Access method: http://www.stat.fi/til/yrti/index_en.html

TABLE 5: Use of procurement design rules above and below the EU threshold

	EU-procurement	National procurement
Lowest price	63 %	82 %
Scoring auction	27 %	18 %
Free entry	88 %	96 %
Restricted entry	7 %	3 %
Partial accepted	10 %	8 %
Partial not accepeted	90 %	92 %
Engineer's estimate (M€) (mean)	6.31	0.73
Market size as registrations (mean)	27.60	22.45
Number of observations	124	1698

Notes: Remember that EU-procurement refers to the extended regulation. EU-procurements here are not made by EU and there is no sign that that these procurements would attract new international or European bidders.

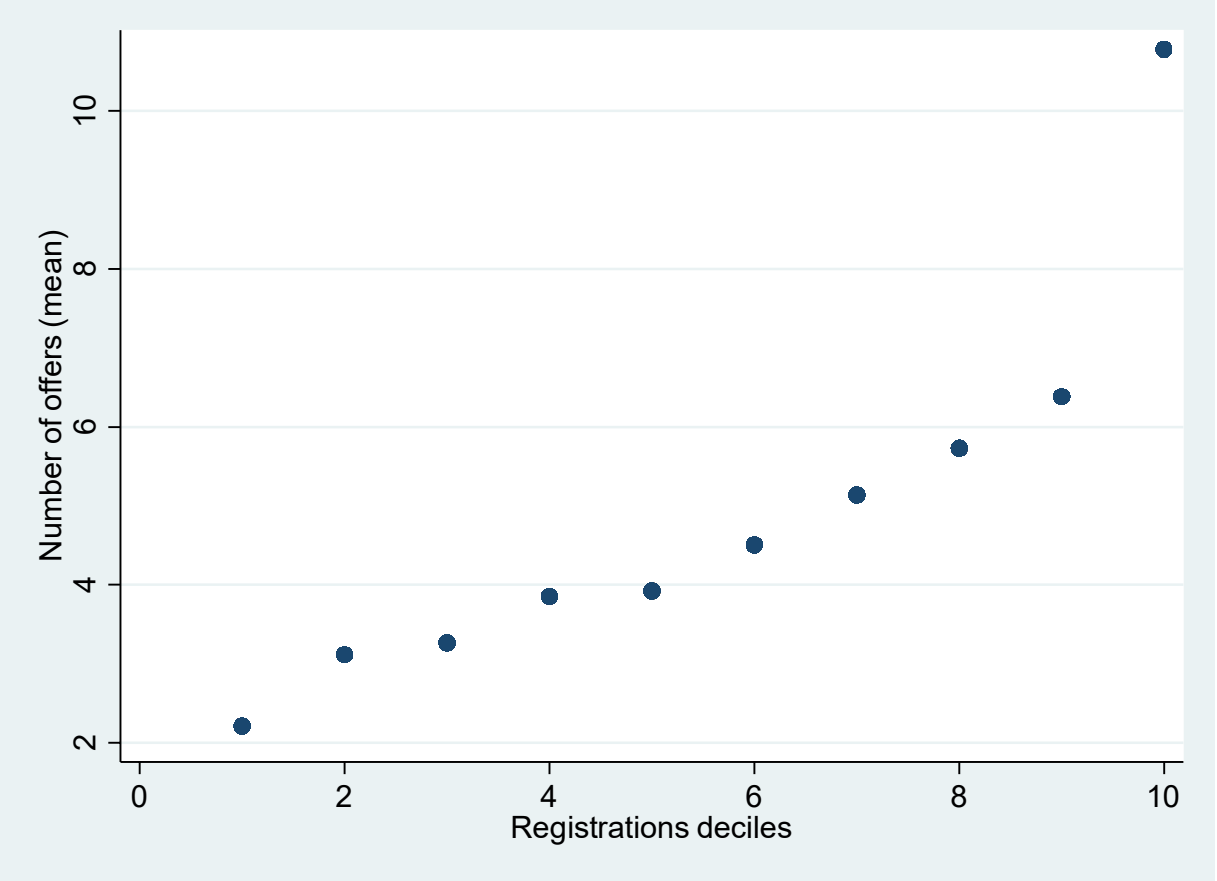
The biggest difference between EU-procurements and National procurements is the size. As TABLE 5 demonstrates, the average size of an EU-wide procurement was 6.31 million euros, while the average size of a national procurement was 0.73 million euros. This is, of course, expected because all procurements over the threshold of 5 278 000 euros were EU-wide procurements by law. Notable is also that the use of a scoring auction was clearly more common in EU-wide procurements, where the portion of scoring evaluation was 27%, compared to 18% in national procurements.

Number of registrations, which means the number of suppliers that had shown interest in the project, is a proxy for the market size that is a fundamental piece in determination of number of offers. Registrations as a proxy for market size is the N, number of potential bidders that is used in entry models. When information about costs is not privately known for the symmetric potential suppliers, as in the Levin and Smith (1994) the registrations only affect the average number of offers only when potential suppliers N is close to optimal number of actual bidders n*. If $N < n^*$, an increase in N will increase the average number of bids, and if $N = n^*$, a

decrease in N will decrease the average number of bids. In a Samuelson model (1985) where private information about costs are perfect, the increase in N will increase the number of bids, but the marginal effect of an increase in N is diminishing.

As it is difficult to assume one entry model in a way that it fits the data, we can use the data to guide the decision to choose the interaction of registrations and offers. FIGURE 7 plots the registrations percentiles with the means of number of received offers. As we can see, the actual relationship between the potential suppliers and received offers based on the data is linear. The outlier in the 10th decile is explained by the larger spread. Based on this evidence, linear relationship is used in the regression models.

FIGURE 7: Registration deciles and number of received offers



Notes: 1st decile has least registrations and 10th has the most. See the table about definitions of the deciles in TABLE 16 *in Appendix.*

As registration is costless, we can expect that all potential suppliers will do it. Potential supplier is someone who based on the procurement description thinks they have the knowledge

and capacity to supply the described service at the time and place required, and that their expected value of participation is larger than zero.

Data from TABLE 6 collects descriptive statistics of bidders and their bidding behavior by their size. First significant observation is that large enterprises were significantly more likely to participate in the public procurement competitions than micro enterprises or even small and medium size enterprises. Comparing the estimated number of large enterprises, 74, shown in TABLE 7 with the actual number of distinct bidders in the data, 233, shows that the majority of the large enterprises were active in public procurement competitions, and additionally, the large enterprises had multiple entries on the list because divisions were sometimes counted as different organizations. On the other side of the spectrum, the micro enterprises that are the most numerous group in Finland, were actually very unlikely to participate even in one public procurement, and large percentage of those micro enterprises that did participate, only participated in exactly one, shown by the statistic in the table that 65% gave only one offer. This observation may suggest that there are barriers of an entry to the public procurement competition that most micro and half of the small and medium size enterprises aren't willing or able to overcome. Another possible explanation is that micro enterprises, and, to some extent small and medium size enterprises are so disadvantaged in price or price per quality measures, that for them the estimated value is smaller than the entry costs. On the other hand, the small and medium sized enterprises that did participate in the public procurement competition, were on average more active and participated in more competitions than large enterprises on average. However, that average number of bids made isn't very useful description of the behavior because the standard deviation, the spread, in activity was large for both small and medium size enterprises and large enterprises. This together with the information that the proportion of bidders who participated only once is large, 54% of all, signals that some of the bidders were very active in the public construction project market whereas others were relatively inactive. Even though strong conclusions cannot be made with this information alone, this may suggest that in order to gain profit from public construction project market, suppliers have to specialize to some extent.

Both micro enterprises and small and medium size enterprises were mainly regional or local operators, whereas large enterprises were mainly national. Large enterprises were more than twice more active in public procurement competitions outside of their home region compared to the other two groups, although even for them local and regional bids were more than one third of all the bids. This observation underlines the construction sector work as a

location dependent. It is difficult to operate in areas where enterprises don't already have a presence, which explains the clear home area bias in bidding behavior.

TABLE 6: Descriptive data about suppliers

Statistic	Micro	SME	Large	Total
Number of bidders	980	1052	233	2265
% of bids local*	27 %	23 %	10 %	23 %
% of bids regional*	51 %	47 %	26 %	46 %
% of bids not local or regional*	23 %	30 %	65 %	30 %
number of bids made in avg.	2.02	4.03	3.69	3.13
number of bids made in avg. S.D.	(2.93)	(6.74)	(6.51)	(5.48)
% of bidders that made only one bid	65 %	46 %	47 %	54 %
Avg. size of procurement	2.32	1.93	2.28	2.13
Avg. size of procurement S.D.	(6.72)	(4.68)	(3.31)	(5.55)
Avg. size of procurement excl 455	1.41	1.77	2.28	1.68
Avg. size of procurement excl 455 S.D.	(4.16)	(4.09)	(3.31)	(4.04)

Notes: All data is based on actual valid bids. Registrations or rejected bids not included. (*) Data about local and regional bids only for those bidders who address information was collected. Address information was collected quasi randomly for 1472 out of 2265 bidders. Information is lacking for two reasons: 1) typos in raw data 2) Web scraping program was timed out by the website. I divided the data to ten parts and run the program for each. Time out caused random number of dropped data point always in the end of each sub-data.

TABLE 7: Representation of suppliers of different size in the data

Statistic	Micro	SME	Large	Total
Number of enterprises in all sector in Finland	349021	20259	660	369940
Estimated number in construction sector**	39090	2269	74	41433
% estimated in population by size groups	94.35 %	5.48 %	0.18 %	100.00 %
% in the sample by size groups	43.27 %	46.45 %	10.29 %	100.00 %

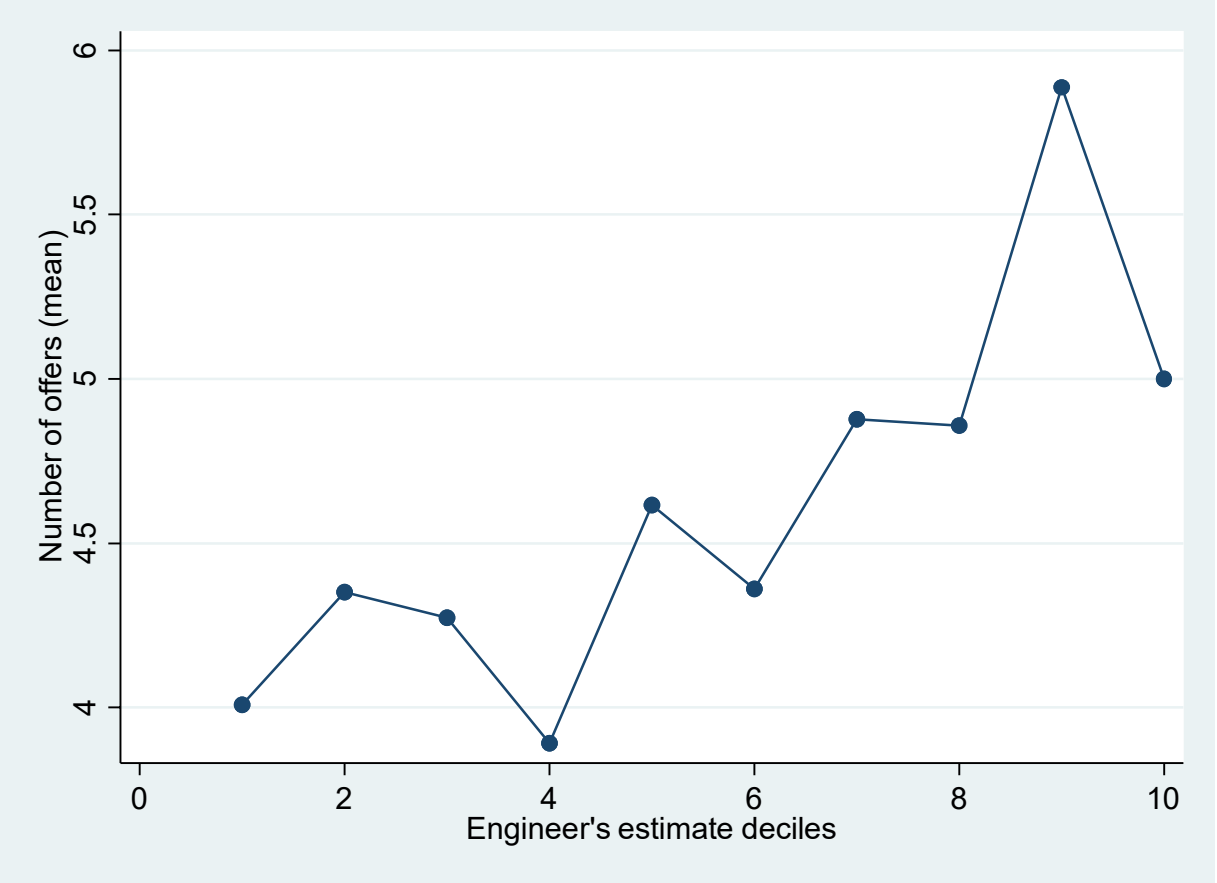
*Notes: ** Based on the number in Statistic Finland data that 11.2% of the both turnover and number of employees came from and worked on construction sector. Source: https://www.tilastokeskus.fi/tup/suoluk/suoluk_yritykset.html accessed 5.6.2021*

The value of the contract is important because the data has shown that it affects the desirability of the procurement competition. Theoretically, we can think about an auction where there is a fixed entry cost. If there are two otherwise similar auctions but another one has higher value, the higher value competition will receive more bidders, because potential bidders are balancing the estimated value from winning with the entry costs. When profit rises and entry costs stays fixed, the expected value of participation increases. Thus, the value of the contract, estimated by an engineer, should in theory have a positive impact on the received offers by increasing the lucrativeness of the project, at least if there are no capacity constraints.

If the potential bidders face capacity constraints, the estimated value can have negative impact when the value is very large. In this kind of situation, there would be just a few suppliers that had enough available capacity, thus limiting the amount of received offers. Given that the projects in the data are relatively small and the number of bidders in all three size categories quite large, this is unlikely playing a large role in the determination of the number of bids.

Data confirms that the engineer's estimate is positively correlated with the number of offers. FIGURE 8 plots the engineer's estimate deciles and number of offers. The relationship is not as clear than with the registrations, and there is much more variance. It is better to test if quadratic engineer's estimate would improve the fitness of the model.

FIGURE 8: Deciles of engineer's estimates and number of received offers



Notes: 1st decile is the smallest and 10th the largest. See the table about definitions of the deciles in TABLE 17 *in Appendix.*

5.2.4 Fixed effects

Fixed effects control unobserved differences between groups. The reason to add fixed effects is to assume that groups differ in unobserved variables that correlate with the treatment, but inside the groups those unobserved variables are fixed.

There are three sets of groups that can be used as fixed effect. First, there is the CPV 3-digit categorizations that controls the type of project. Any project type specific differences are larger between the groups than inside the groups. Second, there are regions that control the regional factors in the market and regional administrative differences. The markets are more similar inside the groups than across the groups. Third and last, there are procurers that control the differences in the local market in addition to the regional market, and control the procurer specific administrative differences. Two procurements made by the same procurer face the same market and have the same administrative qualities, whereas two procurements made by

different procurers can face different markets and have administrative differences that correlate with the treatment.

In order to minimize the risk of omitted variable bias, we should use both CPV and procurer fixed effect, and in order to limit the loss of the power, we should use only CPV or CPV and region. The problem with procurer fixed effect is that there are 82 procurers, of which only 42 had more than ten procurements and only four had hundred. Together with CPV fixed effects there would be 410 pairings, which would mean that many of those groups wouldn't have variance in the treatment variable. Solution to this dilemma is to run main regression for five different fixed effects: i) CPV ii) Region iii) CPV & Region iv) Procurer v) CPV & Procurer.

5.3 Descriptive statistics and correlation with number of offers

The four tables below show the representation and correlation of each control variable with the number of offers and by the bid evaluation rules. TABLE 8 shows association of auction rules and the offer deciles. The table shows that the partial bidding is largely overrepresented in the largest offer decile, in scoring auction even 50% of the procurements in the largest decile allowed partial bidding.

TABLE 9 shows association of other control variables and offer deciles. There are a few observations to note. First, the EU-procurements are over-represented in the largest decile with both bid evaluation rule. The engineer's estimate very clearly positively correlates with the number of offers in first-price auctions. This is in line with the rumors inside the industry that small construction[30] projects are not seen lucrative.[31] However, for unknown reason, the correlation between value and offers is not as clear in scoring auctions.

TABLE 10 and TABLE 11 show representation of different project types in each offer decile. Building installation and building completion works are over-represented in the lowest deciles with both bid evaluation rules. Hiring machinery and operator is over-represented in the highest decile with both bid evaluation rules. Complete and partial construction and civil engineering projects seemed to get more offers in first-price auction, where it was over-

[30] Below 100 000€ seen as a very small construction project according to my contact that works in a larger company in the industry.

[31] My own unproven hypothesis is that small projects have larger demand on expensive and scarce administrative work in relation to the turnover and profit.

represented in mid-to-high deciles, than in scoring auctions, where it was over-represented in low-to-mid deciles.

TABLE 8: Representation of other auction rules in each decile of number of offers, by bid evaluation rule

	Lowest price			Scoring auction		
offer deciles	Free entry	Restricted entry	Partial accepted	Free entry	Restricted entry	Partial accepted
1	0.97	0.02	0.05	0.90	0.10	0.10
2	0.98	0.02	0.01	0.97	0.00	0.12
3	0.96	0.04	0.05	0.96	0.04	0.09
4	0.98	0.01	0.03	0.97	0.03	0.03
5	0.96	0.04	0.03	0.96	0.00	0.06
6	0.97	0.02	0.09	0.95	0.03	0.13
8	0.96	0.04	0.05	0.87	0.09	0.18
9	0.94	0.06	0.13	0.91	0.06	0.19
10	0.91	0.08	0.27	0.94	0.04	0.50
Total	0.96	0.03	0.07	0.94	0.04	0.17

TABLE 9: Descriptive data about control variables in each decile of number of offers, by bid evaluation rule

	Lowest price			Scoring auction		
offer deciles	EU-procurement	Estimated value	Registrations	EU-procurement	Estimated value	Registrations
1	0.02	0.41	15.19	0.00	0.85	15.70
2	0.01	0.51	14.85	0.03	1.14	15.30
3	0.05	0.58	16.58	0.02	0.82	18.22
4	0.05	0.72	18.65	0.13	1.41	22.03
5	0.04	0.88	20.88	0.24	1.58	23.33
6	0.09	0.85	23.55	0.10	0.79	21.90
8	0.07	0.96	26.24	0.07	0.70	23.18
9	0.10	1.02	30.89	0.06	0.77	27.56
10	0.14	1.90	42.45	0.15	3.51	40.88
Total	0.06	0.84	22.50	0.10	1.35	24.09

TABLE 10: Representation of construction project types in each decile of number of offers in procurements with price-only evaluation

	Lowest price					
offer deciles	Site preparation	Construction and civil	Building installation work	Building completion	Machinery and operator	Group-code missing
1	0.03	0.26	0.12	0.07	0.00	0.52
2	0.03	0.22	0.09	0.08	0.00	0.58
3	0.03	0.33	0.06	0.03	0.00	0.55
4	0.04	0.37	0.07	0.02	0.00	0.51
5	0.02	0.38	0.09	0.03	0.00	0.48
6	0.05	0.42	0.05	0.02	0.01	0.46
8	0.05	0.45	0.07	0.01	0.01	0.41
9	0.07	0.51	0.06	0.00	0.00	0.37
10	0.08	0.26	0.06	0.01	0.07	0.52
Total	0.04	0.37	0.07	0.03	0.01	0.49

TABLE 11: Representation of construction project types in each decile of number of offers in procurements with price and quality evaluation

	Scoring auction					
offer deciles	Site preparation	Construction and civil	Building installation work	Building completion	Machinery and operator	Group-code missing
1	0.00	0.20	0.30	0.00	0.00	0.50
2	0.00	0.36	0.12	0.09	0.00	0.42
3	0.00	0.26	0.28	0.02	0.00	0.44
4	0.03	0.29	0.23	0.03	0.00	0.42
5	0.00	0.45	0.08	0.02	0.02	0.43
6	0.03	0.38	0.13	0.00	0.03	0.44
8	0.00	0.16	0.22	0.02	0.11	0.49
9	0.00	0.16	0.09	0.00	0.09	0.66
10	0.04	0.04	0.10	0.00	0.23	0.58
Total	0.01	0.26	0.16	0.02	0.06	0.48

6 Results

6.1 Models

Model 1 in the first column of TABLE 12 shows that across all the observations, keeping the market size fixed, the procurements with scoring auction got on average 0.7 more viable offers than their first price auction counter parts. The effect is statistically significant in the Model 1.

However, when the other major procurer choices about the competition design are introduced in the model 2, the estimated difference drops by 50% and loses statistical significance. The statistically significant and large positive effect of variable *partial bids accepted* together with the earlier observation that partial bidding was more likely to be allowed in the scoring auction than in the first price auctions signals that model 1 was biased. Variable *partial bids allowed* was positively correlated with both the endogenous variable *offers* and the treatment.

Results of the model 3 show the same problem with the variables *engineer's estimate* and *EU procurement*. I've shown earlier that both variables were positively correlated with the use of scoring auction, and now the results show both are positively correlated with the endogenous variable as well. The coefficient was suffering from the omitted variable bias in models 1 and 2. The model 3 is the best model out of the three.

The model 3 estimates that the scoring auctions got 0.2 more viable offers than comparable procurements with the first price auction format. The null hypothesis that the bid evaluation rule doesn't affect the desirability of the competition cannot be rejected based on the evidence so far. The differences seen between the groups at an aggregate level seem to be in large part explained by the higher usage of partial bidding in scoring auctions, and to some degree by the scoring auction's larger average size and higher usage in EU procurements that received more offers on average than national procurements.

TABLE 12: Regression results for entry without fixed effects

	Model 1	Model 2	Model 3
scoring auction	0.716**	0.352	0.214
	(0.240)	(0.221)	(0.243)
other bid evaluation	-0.965	-1.727*	-3.079*
	(0.913)	(0.859)	(1.332)
registrations	0.211***	0.204***	0.191***
	(0.0216)	(0.0217)	(0.0146)
restricted entry		2.213***	1.967**
		(0.548)	(0.606)
negotiations		0.188	0.606
		(1.301)	(1.181)
partial bids accepted		3.565***	3.516***
		(0.417)	(0.439)
engineer's estimate M€			0.224
			(0.151)
EU procurement			0.969
			(0.545)
_cons	-0.109	-0.252	-0.199
	(0.448)	(0.450)	(0.356)
N	1822	1822	1765
R^2	0.406	0.465	0.479

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
See joint F-tests for added variables in Appendix in Table 20

TABLE 13 allows us to analyze if the positive coefficient persists when the context of the procurement is controlled by various sets of fixed effects. It also allows us to get more information about how much the project type and regional and procurer specific factors affect the performance of the scoring auction relatively to first price auction.

Table has 5 models with different sets of fixed effects. Model 4 has the project type fixed effects measured by the CPV 3-digit code, model 5 has region fixed effects, model 6 has both project type fixed effects and region fixed effects, model 7 has procurer fixed effects, and finally, model 8 has both project type fixed effects and procurer fixed effects. We are interested in three numbers when comparing the models: coefficient of the *scoring auction*, which is the

treatment effect in the sample in the given context, standard error of the coefficient that is the accuracy of the estimated effect, and R^2-value that shows how much of variance in the error term the additional control explains.

In the model 4, the further decrease in the coefficient of *scoring auction* indicates that the positive effect of the estimate we saw in the model 3 was explained by the difference in the usage rate of the bid evaluation rules for different project types. Especially, scoring auction was used much more regularly with project type 455, *hire of construction and civil engineering machinery and equipment with operator*, that also had significantly higher average number of received offers than other project type. Models 1 to 3 were suffering from omitted variable bias, because project type 455 was both positively correlated with both the choice of the scoring auction, and number of received offers.

In model 5 we drop project type fixed effects and include region fixed effects. Exclusion of the project type fixed effects means the coefficient has upward bias, thus model 5 coefficient should be compared to model 3. Coefficient being quite a bit larger in model 5 indicates that the difference between treated and comparison group is larger inside the same region than across the regions. This is a clue that the difference between scoring auctions and first price auctions may exists, but the context needs to be better controlled. However, just like with in models 2 to 4, the null hypothesis is not rejected. In model 5, R^2 and adjusted R^2 are smaller than the respective numbers in model 4. Region fixed effects explain less of the variation and may be less of a good fit than project type fixed effects.

Model 6 shows again the significance of the project type fixed effect. Adding project type fixed effect in addition to the region fixed effects will lead to a significant drop in the *scoring auction* coefficient just like in model 4. Although the estimate is statistically clearly insignificant, the larger point estimate in model 6 compared to model 4 confirms that the difference between treatment and comparison groups is larger inside the regions than across the regions. It is interesting to see if the same trend continues when procurer fixed effects are introduced.

Model 7 drops region and project type fixed effects and adds procurer fixed effects. Keep in mind that procurer fixed effects are expected to be clearly better control than the regions, but they may have problems with lack of variation inside the procurer groups. If there is no variance in the choice of bid evaluation rule inside some of the procurer groups, that part of data is not used to calculate the coefficient when procurer fixed effects are added.

Model 7 shows significant increase in the coefficient of *scoring auction*, and the effect is statistically significant. However, we know it biased upwards because of the exclusion of the

project type fixed effects. Comparison of the R^2-values and adjusted R^2-values with the models 4 and 5 show that procurer fixed effects increase the fit of the model the more than project type fixed effects and obviously more than region fixed effects. Because coefficients and the fitness of the model change from region to procurer, the region fixed effects are probably not an excellent proxy for differences in markets and administrative characteristics. Based on the evidence, regions are not uniform in market measures or administrative qualities.

Finally, model 8 completes the analysis of fixed effects by including project type fixed effects in addition to procurer fixed effects. The same pattern continues – Addition of project type fixed effects lead to an decrease of 0.3 offers just like happened in models 4 and 6. Point estimate is that similar competition with same amount of interested suppliers in the market and the same project type and the procurer, gets 0.4 more viable offers if it uses scoring auction instead of first-price auction. The difference between treatment and comparison is not statistically significant.

The most important finding from the TABLE 12 and TABLE 13 is that the more the context of the procurement is controlled, the larger is the point estimate for the treatment effect. We can compare models 3, 5, and 7, or we can compare the models 4, 6, and 8, but it doesn't change the conclusion that the effect grows larger when the accuracy of the controls is increased. This evidence would suggest that the difference may exists although the null hypothesis is not rejected.

From the group of control variables, *restricted entry*, *partial bids accepted,* and *EU-procurement* all had strong positive correlation with the number of offers received. All three effects were statistically significant. For procurements with partial bidding, positive correlation was expected, because they have effectively many competitions per one project instead of one competition for the whole project. That type of design may attract bidders that wouldn't otherwise participate. Strong positive estimates were not expected for restricted entry and EU-procurements. I first thought that the registration process would have also been restricted in procurements with restricted entry, but after plotting histograms for registrations for both entry rules, and noticing no difference in market size, I have retired that explanation.[32] However, the positive correlation can be explained by coordination costs that are expected to be significantly higher with open bidding than restricted bidding. Coordination costs arise according to Levin and Smith (1994) in an auction, when entry costs exists, potential bidders have uncertainty about their costs before paying the entry costs (entry costs take form of information acquisition

[32] Histograms can be found from FIGURE 14 in Appendix.

costs), and there are more potential bidders than is the maximum number of potential bidders deciding to participate and pay the entry costs that still allows positive expected value calculated after paying entry costs. Coordination cost occur, because sometimes suboptimal number of potential bidders decide to participate, which leads to waste. Potential bidders can react by participating less often. In a competition where coordination costs are relevant, restricting the number of participants will increase the average number of bids.

The positive correlation of EU-procurement and number of offers is unexpected as well. Potential explanation is that one or more of the rules that apply to EU-procurements, but not to national procurements were making participation more lucrative to the potential bidders. It is possible to understand how a standard, more well-defined framework for the rules of the procurement can make the outcome of participation more predictable and thus more attractive. But it is just as likely that the difference is caused by comparison of apples and oranges, given that there was only 35 EU-procurements under the value of 5 million and two national procurement valued over 5 million. Therefore, comparing national procurement and EU-procurements while assuming the scale of the project fixed may be misleading.

Variable *registrations* had positive and consistently statistically significant effect as well. Everything else constant, every five additional potential suppliers lead to one additional bid.

TABLE 13: Regression results for received bids with different fixed effects

	Model 4	Model 5	Model 6	Model 7	Model 8
scoring auction	-0.0573	0.477	0.199	0.720**	0.401
	(0.260)	(0.259)	(0.288)	(0.257)	(0.272)
other bid evaluation	-3.137**	-2.698	-2.661*	-1.243	-1.256
	(1.215)	(1.379)	(1.250)	(1.104)	(1.185)
restricted entry	1.964**	1.699**	1.753**	1.506*	1.489*
	(0.599)	(0.632)	(0.630)	(0.650)	(0.658)
negotiations	0.515	0.466	0.360	0.335	0.374
	(1.173)	(1.292)	(1.291)	(1.365)	(1.317)
partial bids accepted	2.522***	3.431***	2.498***	3.237***	2.361***
	(0.528)	(0.425)	(0.523)	(0.444)	(0.542)
registrations	0.187***	0.196***	0.190***	0.203***	0.196***
	(0.0140)	(0.0149)	(0.0143)	(0.0160)	(0.0152)
engineer's estimate	0.226	0.223	0.227	0.231	0.231
	(0.132)	(0.152)	(0.134)	(0.156)	(0.136)
EU-procurement	1.159*	1.158*	1.260*	1.903**	1.922**
	(0.534)	(0.553)	(0.547)	(0.604)	(0.610)
CPV3	Yes	No	Yes	No	Yes
Region	No	Yes	Yes	No	No
Procurer	No	No	No	Yes	Yes
N	1765	1765	1765	1765	1765
R^2	0.508	0.501	0.525	0.541	0.563
adj. R^2	0.504	0.494	0.517	0.516	0.538

Robust standard errors in parentheses
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*
See joint F-tests for added variables in Appendix in Table 20

6.2 Economic significance and effect on the margins

The point estimate from the model 7 of 0.4 offers is around 8% of the average of 4.84 offers the procurements received on average. Although the estimate isn't statistically significantly different from zero, the point estimate can be economically meaningful depending on what is the expected value of an extra bidder. Trying to argue or estimate the exact social value an extra bid has is out of the reach of this paper. However, Tukiainen and Jääskeläinen (2019) used the data from the same source and run regression with bid margin as a endogenous

variable. They found that number of bidders had quadratic relationship with the bid margin. The number of bidders had a negative correlation with bid margin from two to six bidders, while for more than six bidders a similar correlation wasn't found. This supports our expectation that the number of bidders has diminishing marginal effect on procurement outcomes. For the economic significance of a potential effect on the number of bidders, it is relevant to study if the potential effect has impact also on the margins where it has most impact. The same +0.4 offers would be economically significant if it is relevant also in the critical 1-6 bids margins, and less significant if it is relevant only in the higher end of bid distribution.

TABLE 14 below shows the estimated impact of scoring auction on the most relevant margins. The regression model used is the same than in model 8, but this time the endogenous variable is binary and gets value 1 if it falls under given threshold, and zero otherwise. Negative coefficient would indicate economically positive effects, whereas positive coefficient indicates negative effect.

Coefficients of *scoring auction* in TABLE 14 show that keeping everything else constant, scoring auctions were less likely to fall short of the given threshold in six out of seven cases, and fall short of the threshold more often than first-price auction only once. Out of the estimates only three latter ones are statistically significant, and the point estimate trends downwards when the threshold increases, which indicates that the marginal effect is perhaps larger for higher threshold. The estimated effects on the margins from one to four bidders are small, the point estimate being from 3 percentage points to -3 percentage points, and average effect being 1 percentage point. For example, that means that if a procurer with certain specs and first-price auction fell behind the threshold 14 times out of 100, similar procurement with scoring auction fell behind 13 times out of hundred. To give some idea what is the economic impact of this, think of procurement that has value 1 million euros, and would otherwise have 20% winning margin that is worth 200 000 euros. Tukiainen and Jääskeläinen estimated that the impact of one bidder in this range is around 1 percentage point. That percentage point is worth 10 000 euros. Now, given that around half of the procurements receive number of offers in these margins, for 1700 procurements that would mean that 1% of 850 procurements, that is 8,5, would receive an extra bid if causation would exist. This would total 85 000 euros saved in procurement costs in construction sector.

The estimated effects on the margins from five to seven bidders are larger. The estimated effect ranges from -6 to -8 percentage points, and are all statistically significant. If a procurer with certain specs and first price auction fell behind the threshold 70% of the time, similar procurement with scoring auction fell behind 63% of the time. In the range of five to seven

bidders the scoring auction seems to be attributed with significant improvement on margins. But, the economic significance of this improvement may not be large because the marginal effect of an extra bidder to procurement is expected to be relatively small. Let's do the same economic calculation: let's assume plus one bidder is still worth 10 000 euros, and this range of bids is relevant to 15% of the 1700 procurement which means 255 procurements. Seven percentage of 255 procurements mean that 17,85 are affected. Estimate is that 178 500 euros would be saved in procurement costs in construction sector.

Economic significance estimated by bidders margin would signal that the magnitude of the effect is not meaningful for the real economy, given that potential savings would be in hundreds of thousands of euros while the total value of public procurements in construction sector in this data was 1 700 millions of euros.

TABLE 14: The effects of scoring auction on different margins

	Y = 1, if n<1	Y = 1, if n<2	Y = 1, if n<3	Y = 1, if n<4	Y = 1, if n<5	Y = 1, if n<6	Y = 1, if n<7
scoring auction	-0.0260	-0.0187	0.0324	-0.0303	-0.0747*	-0.0810**	-0.0623*
	(0.0166)	(0.0253)	(0.0317)	(0.0331)	(0.0333)	(0.0308)	(0.0284)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CPV3	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regions	No	No	No	No	No	No	No
Procurer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1765	1763	1762	1754	1744	1721	1695
R^2	0.105	0.153	0.194	0.237	0.273	0.291	0.300
adj. R^2	0.055	0.106	0.150	0.195	0.233	0.251	0.261

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Notes: Y gets value 1 when the number of offers falls below the given threshold, thus positive sign signifies higher probability of falling below and negative sign signifies lower probability of falling below the given threshold.

6.3 Potential favoritism

As discussed earlier in the literature section, favoritism may affect the consistency of entry. The type of bidders that are favored are more likely to enter when favoritism exists, meanwhile not preferred type will bid less often when the favoritism exists. In Finnish context

it is unclear, what type of bidders would be favored if favoritism did exists. In-house units do no need to be favored through the procurement rules, because the procurement law offers more direct way of favoring the in-house units, outside of the official procurement protocol.

I have presented a hypothesis that scoring auction can potentially be more suited to favor a certain type of bidder than first-price auctions. If that would be true, and if favoritism exists, we would expect to see patterns in bidders behavior. If favoritism did exists, we would expect the favored bidders to enter scoring auctions more often than first-price auctions. To test this, I have created three groups for bidders: bidders that showed preference to first-price auctions, bidders who showed preference for scoring auctions, and comparison group for reference[33].

The results in TABLE 15 presents the observed differences between the created bidder groups. Bidders who showed preference for first-price auctions, were more likely large and not local or regional bidders. They were also more active in public procurement market, measured in both registrations and offers. Bidders who showed preference for scoring auctions were more likely small and medium sized enterprises and more often local or regional bidders.

Evidence is only anecdotal and doesn't proof that favoritism exists or what type of bidders would be favored. But based on the presented evidence, scoring auction format looks often to be preferred by small and medium sized regional suppliers, meanwhile first-price auction seems to be favorable format for large national suppliers.

[33] Comparison group: 437 observations, scoring-preference: 33 observations, price-preference: 26 observations. Comparison group includes all bidders that had made five or more bids. For preference groups, I have run hypothesis testing with null-hypothesis that, after showing interest by registration, bidder was as likely to make a bid in first-price auction than in scoring auction. If null-hypothesis is rejected by 90% confidence interval, the bidder is assigned to one of the preference groups. I have also tested both groups for the null-hypothesis that the group was formed purely by change. The null-hypotheses that price-preference group got 26 observation by chance, and scoring-preference group got 33 bidders by chance are both rejected with 5% significance.

TABLE 15: Bidders' preference and difference between price-only preference and scoring preference

	Price preference	Scoring preference	Comparison
% Micro	0.14 (0.35)	0.17 (0.38)	0.25 (0.43)
% SME	0.50 (0.52)	0.73 (0.45)	0.64 (0.48)
% Large	0.36 (0.49)	0.10 (0.31)	0.11 (0.31)
% of bids local	0.09 (0.22)	0.15 (0.27)	0.17 (0.32)
% of bids regional	0.23 (0.33)	0.42 (0.40)	0.30 (0.39)
Registrations made (mean)	72.81 (34.54)	59.21 (52.73)	31.32 (26.72)
Offers made (mean)	28.38 (17.02)	14.82 (11.69)	11.12 (8.90)
Offers / registrations	0.39 (0.16)	0.28 (0.12)	0.45 (0.23)

7 Conclusions

When the entry to the competitive phase of public procurement process is determined endogenously, all choices in procurement rules can potentially affect the number of bids the procurement will receive, that in turn affects the final outcomes of the procurement. One of these choices is the bid evaluation rule that is used to rank the bids. In the Finnish context, the procurers choose between price-only evaluation and price and quality evaluation, of which the latter is called a scoring auction. I compared the potential impact of using a scoring auction instead of lowest-price evaluation to the attractiveness of the competition to the potential suppliers. If one of the bid evaluation rules seems to attract more entry, that can be helpful information for procurers that are suffering from too low participation.

By using identification based on observables, I find that the estimated effect of using a scoring auction instead of a lowest-price auction ranges between 0 to 0.7 offers. The estimates are not statistically significant, but they are quite consistently positive, implying that suppliers may have seen scoring auctions more lucrative than lowest-price auctions on average. I also find that the marginal difference between the two bid evaluation rules is larger when in the margins where the received bids were five or higher, and lower in margins where number of received bids was less than five.

The results should be interpreted carefully and with healthy load of skepticism. The lack of external shock leaves plenty of room for speculation if the estimates suffer from omitted variable bias. Another concern is the lack of accuracy in measuring the type of construction work that can lead us to comparing apples and oranges.

I suggest that probable reason for the potential entry inducing effect of the scoring auction is caused by its documented tendency to leave larger profit margins for the suppliers. However, there are also relevant potential factors that would suggest the scoring auction would deter the entry, including possibly more burdensome process for the bidders. There is a room for future study that would try to estimate and separate potential different effects to increase the understanding of the anatomy of these two common bid evaluation rules.

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Laws

Act on Public Procurement and Concession Contracts 1397/2016

Act on Public Contracts 348/2007

Finnish public procurement practices are directed by the Act on Public Procurement and Concession Contracts that is based on EU directives. Before 2017 procurers followed the older version (348/2007) and since 2017 they followed the newer one (1397/2016). T

Appendix

TABLE 16: Definition of registrations deciles

Registrations deciles	min	max

1	1	9
2	10	12
3	13	15
4	16	18
5	19	20
6	21	24
7	25	27
8	28	31
9	32	38
10	39	153
Total	1	153

TABLE 17: Definition of engineer's estimates deciles

Value deciles	Lower threshold(M€)	Upper threshold(M€)
1	0.008000	0.10
2	0.105000	0.15
3	0.151000	0.20
4	0.210000	0.25
5	0.260000	0.40
6	0.410000	0.50
7	0.506000	0.80
8	0.811000	1.40
9	1.500000	3.50
10	3.546001	45.00
Total	0.008000	45.00

FIGURE 9: CPV 3-digit categories and histograms of received offers

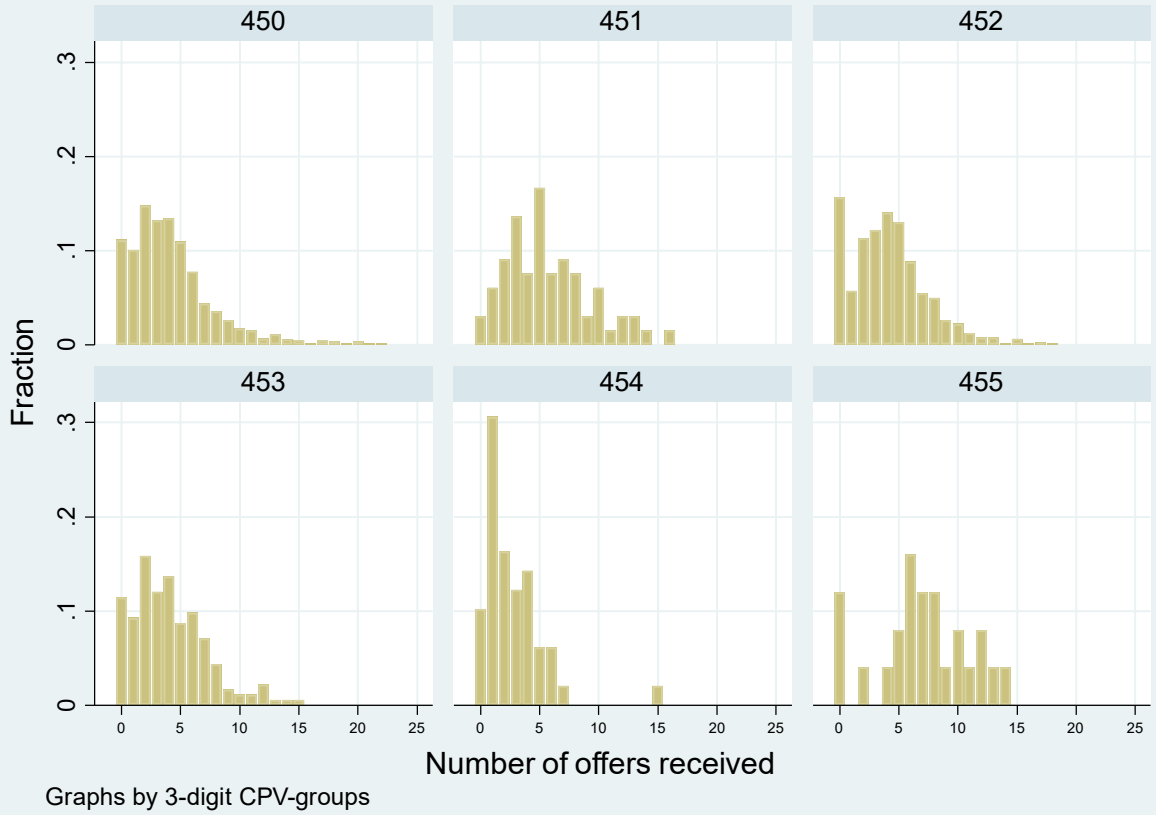


FIGURE 10: Histogram of registrations in procurements

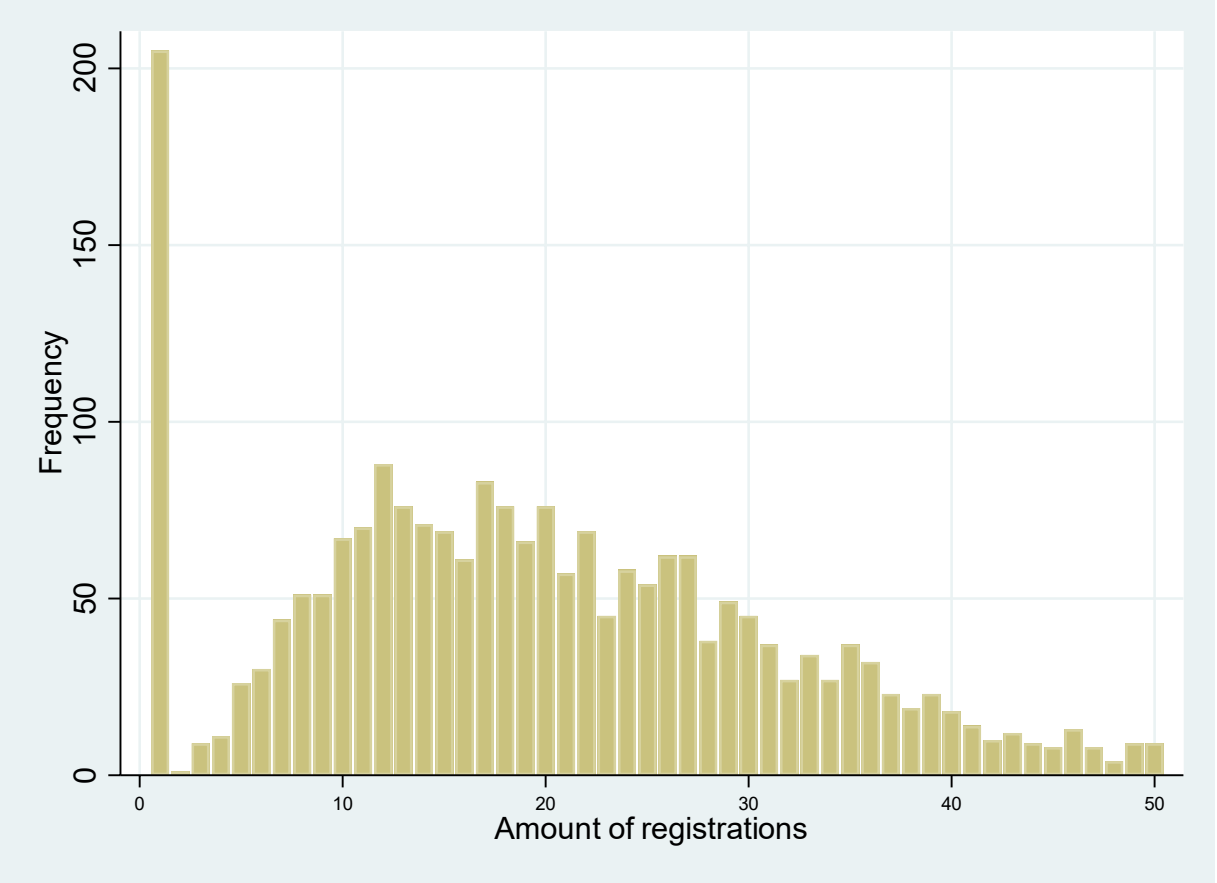
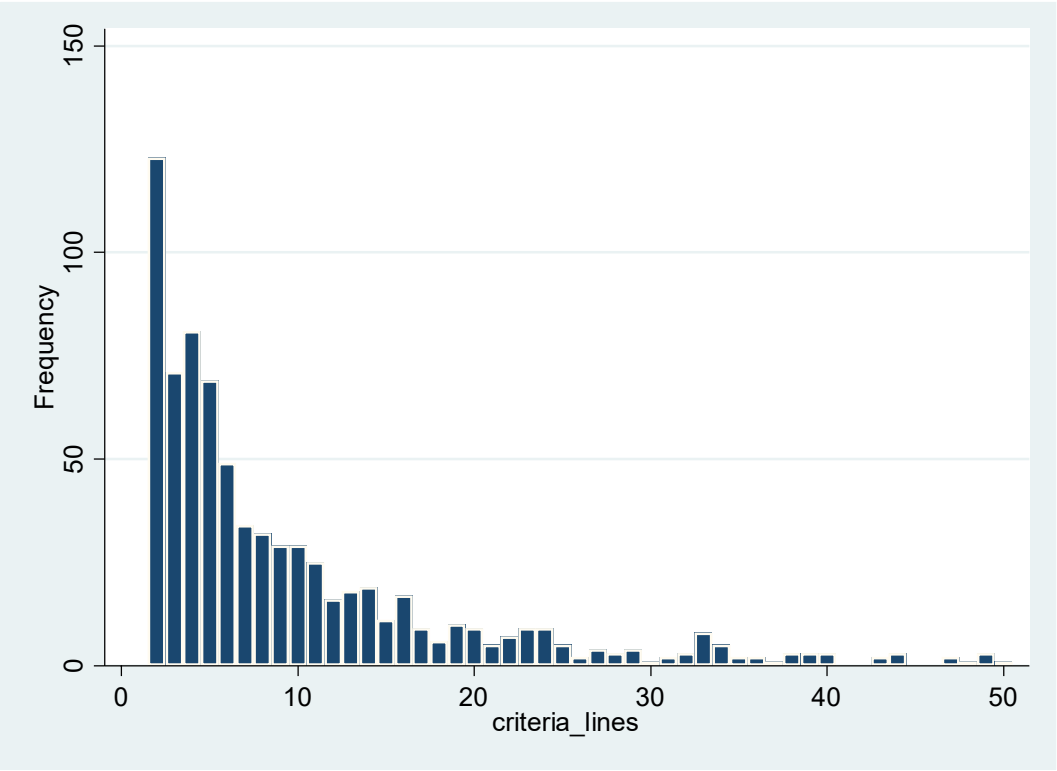
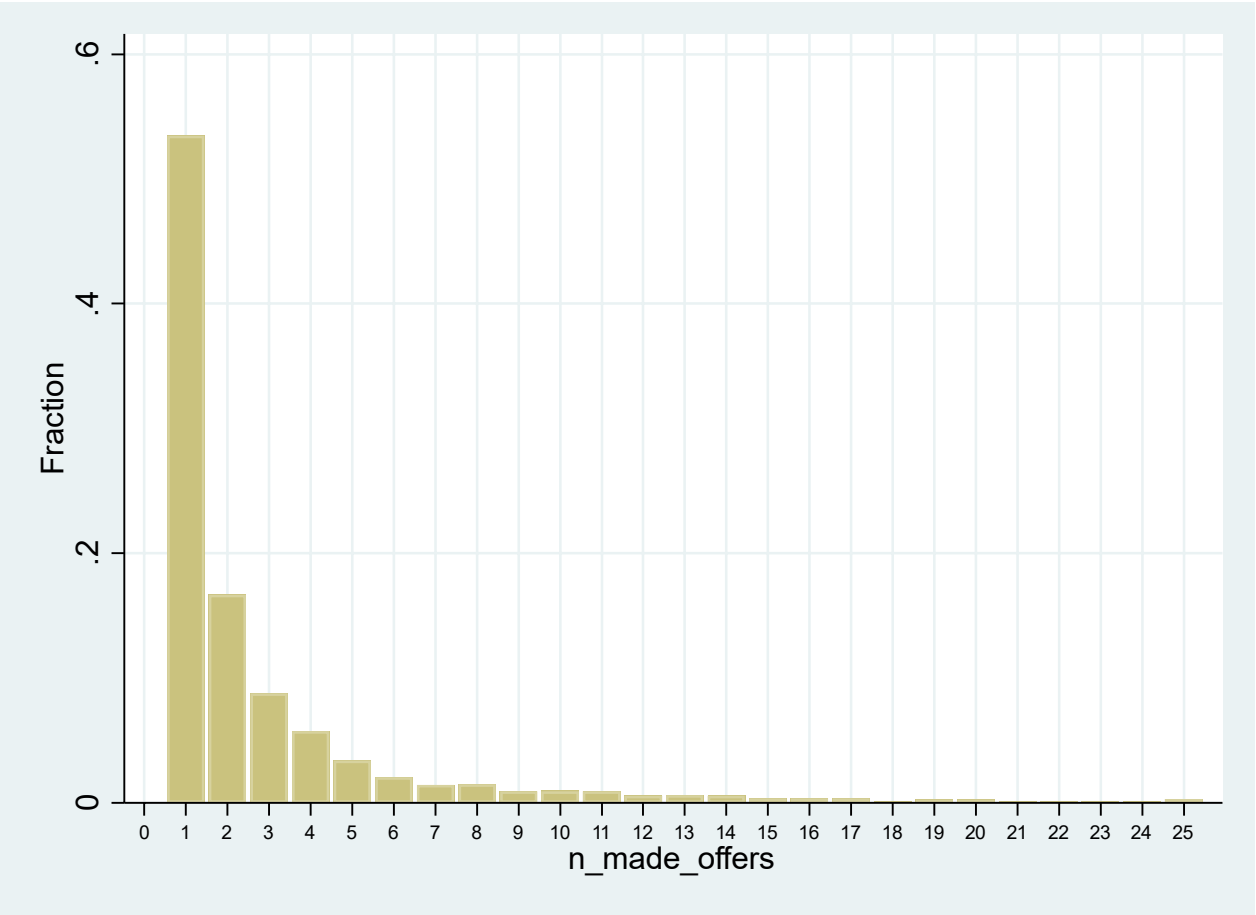


FIGURE 11: Histogram of criteria lines



Notes: Procurements with only one criteria line or over 50 lines in the data excluded

FIGURE 12: Histogram of offers made by distinctive bidders



Notes: Histogram for number of bids each distinctive bidder made in the data. Over half of the bidders only made a single bid. Partially that is explained by the fact that some procurers adapted the use of platform late in the period, leaving no time for cumulating more bids.

FIGURE 13: Regions, population, and received offers

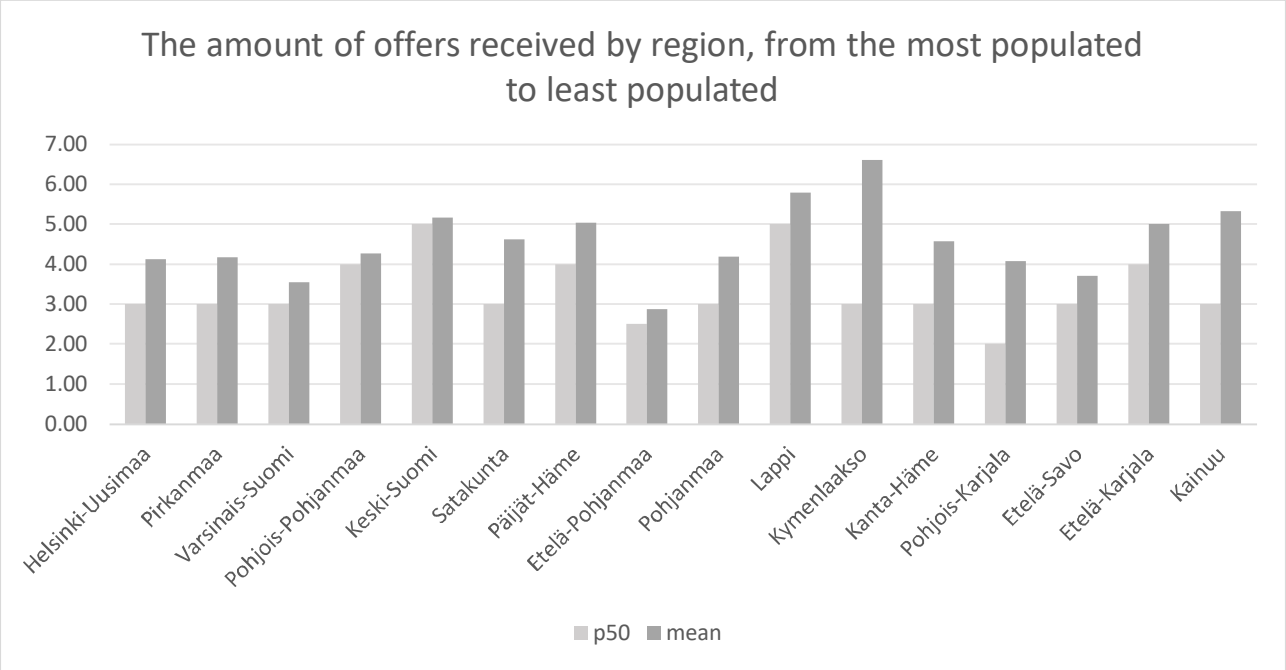
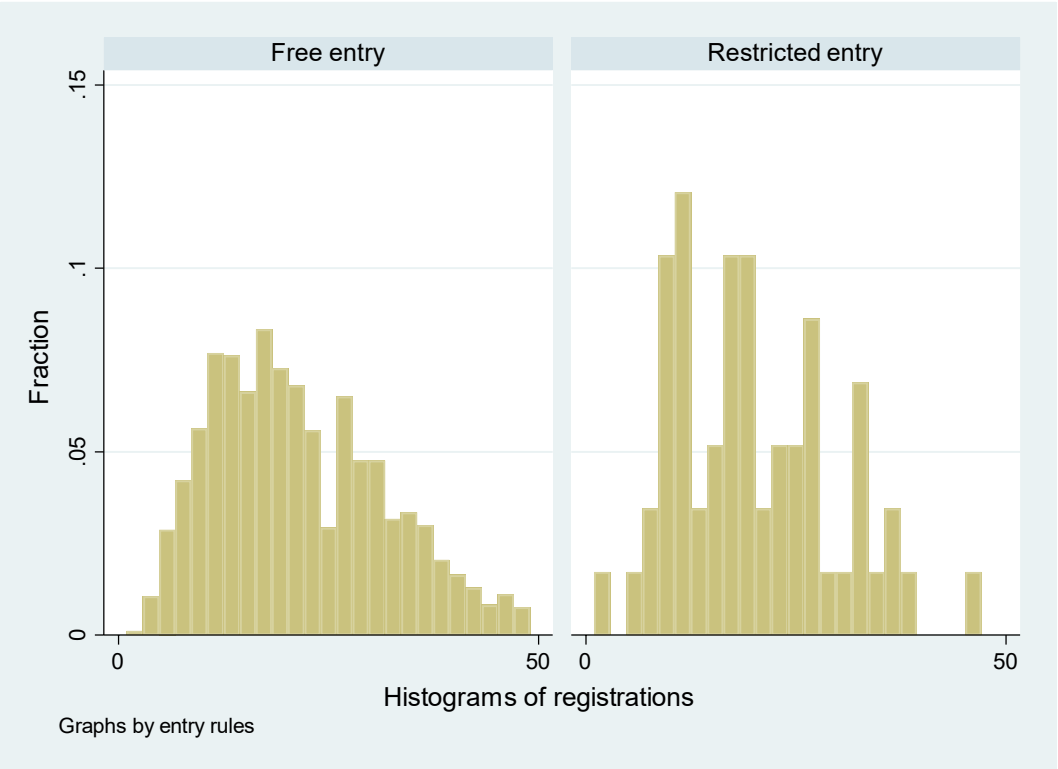


FIGURE 14: Open and restricted entry difference in distribution of registrations in procurements



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Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of offers1

         chi2(1)      =  3250.91
         Prob > chi2  =   0.0000
```

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of offers1

chi2(1) = 3250.91

Prob > chi2 = 0.0000

.

TABLE 18: Effect of scoring auction on number of bids with different fixed effects all coefficients

	Model 4	Model 5	Model 6	Model 7	Model 8
scoring auction	-0.0573	0.477	0.199	0.720**	0.401
	(0.260)	(0.259)	(0.288)	(0.257)	(0.272)
other bid evaluation	-3.137**	-2.698	-2.661*	-1.243	-1.256
	(1.215)	(1.379)	(1.250)	(1.104)	(1.185)
restricted entry	1.964**	1.699**	1.753**	1.506*	1.489*
	(0.599)	(0.632)	(0.630)	(0.650)	(0.658)
negotiations	0.515	0.466	0.360	0.335	0.374
	(1.173)	(1.292)	(1.291)	(1.365)	(1.317)
partial bids accepted	2.522***	3.431***	2.498***	3.237***	2.361***
	(0.528)	(0.425)	(0.523)	(0.444)	(0.542)
registrations	0.187***	0.196***	0.190***	0.203***	0.196***
	(0.0140)	(0.0149)	(0.0143)	(0.0160)	(0.0152)
engineer's estimate	0.226	0.223	0.227	0.231	0.231
	(0.132)	(0.152)	(0.134)	(0.156)	(0.136)

EU-procurement	1.159*	1.158*	1.260*	1.903**	1.922**
	(0.534)	(0.553)	(0.547)	(0.604)	(0.610)
site_preparation	0.627		0.671*		0.783*
	(0.337)		(0.330)		(0.351)
construction_and_civil	-0.491**		-0.305		-0.103
	(0.159)		(0.171)		(0.183)
building_installation	0.278		0.0597		0.400
	(0.269)		(0.270)		(0.306)
building_completion	-0.814*		-0.814*		-0.779*
	(0.332)		(0.345)		(0.382)
machinery_and_operator	5.355***		5.262***		5.417***
	(1.591)		(1.593)		(1.625)
1.region_labelled		0	0		
		(.)	(.)		
2.region_labelled		-2.268**	-3.006*		
		(0.852)	(1.330)		
3.region_labelled		-2.069***	-2.189***		
		(0.541)	(0.533)		
4.region_labelled		-1.684***	-1.831***		
		(0.410)	(0.419)		
5.region_labelled		-2.713***	-2.515***		
		(0.488)	(0.507)		
6.region_labelled		-1.509*	-1.424*		
		(0.607)	(0.617)		
7.region_labelled		-0.704	-0.956		
		(0.484)	(0.497)		
8.region_labelled		-0.245	-0.734		
		(0.847)	(0.781)		
9.region_labelled		-0.326	-0.841		
		(0.564)	(0.561)		
10.region_labelled		-1.675***	-1.672***		
		(0.496)	(0.494)		
11.region_labelled		-1.863**	-2.179***		
		(0.604)	(0.604)		
12.region_labelled		-1.019*	-1.307**		
		(0.446)	(0.443)		
13.region_labelled		-0.855	-0.994*		
		(0.495)	(0.499)		
15.region_labelled		-0.587	-0.782		
		(0.517)	(0.528)		

16.region_labelled	-0.252	-0.454		
	(0.468)	(0.483)		
17.region_labelled	-1.381**	-1.593***		
	(0.444)	(0.460)		
3.hankorg			0	0
			(.)	(.)
4.hankorg			-1.046*	-1.204**
			(0.447)	(0.463)
5.hankorg			-0.368	-0.0419
			(0.466)	(0.541)
6.hankorg			-0.0685	-0.0946
			(0.893)	(0.931)
8.hankorg			-2.474***	-2.153***
			(0.459)	(0.483)
9.hankorg			-1.608	-1.718
			(0.971)	(0.879)
10.hankorg			9.863***	5.785***
			(0.710)	(1.457)
11.hankorg			0.00308	-0.0276
			(0.495)	(0.497)
12.hankorg			0.385	0.508
			(0.567)	(0.591)
13.hankorg			-1.170	-0.997
			(0.656)	(0.635)
16.hankorg			1.214*	1.403*
			(0.603)	(0.616)
22.hankorg			0.206	0.115
			(0.631)	(0.617)
24.hankorg			0.364	0.367
			(0.458)	(0.463)
25.hankorg			1.640	-0.0999
			(2.167)	(1.966)
31.hankorg			-1.494*	-1.279*
			(0.683)	(0.634)
38.hankorg			-0.154	-0.186
			(0.607)	(0.593)
40.hankorg			-0.310	-0.279
			(0.496)	(0.495)
41.hankorg			-1.624*	-1.656*
			(0.689)	(0.683)

43.hankorg	-1.131*	-1.077*
	(0.456)	(0.453)
46.hankorg	-3.025	-2.586
	(1.639)	(1.889)
48.hankorg	-3.160***	-3.087***
	(0.856)	(0.874)
50.hankorg	-1.772***	-1.570***
	(0.479)	(0.450)
56.hankorg	-0.521	-0.608
	(0.492)	(0.501)
61.hankorg	-0.345	-0.348
	(0.950)	(0.929)
63.hankorg	-1.672	-1.032
	(2.877)	(2.953)
68.hankorg	-1.280	-0.952
	(1.110)	(1.106)
76.hankorg	-0.736	-1.000*
	(0.472)	(0.492)
82.hankorg	0.982	0.917
	(0.866)	(0.853)
88.hankorg	-0.908	-0.898
	(0.466)	(0.462)
91.hankorg	-2.603	-2.424
	(1.988)	(1.925)
92.hankorg	-1.214	-1.145
	(0.680)	(0.663)
93.hankorg	-1.412*	-1.505*
	(0.699)	(0.678)
95.hankorg	-0.421	-0.447
	(0.545)	(0.567)
101.hankorg	-0.106	-0.243
	(0.634)	(0.581)
108.hankorg	0.0133	0.241
	(1.564)	(1.449)
109.hankorg	-0.260	-0.0317
	(0.604)	(0.607)
111.hankorg	-0.233	0.398
	(0.840)	(0.865)
114.hankorg	-0.660	-0.788
	(0.437)	(0.425)

117.hankorg	-2.005**	-2.277**
	(0.652)	(0.771)
122.hankorg	-0.0583	-0.448
	(0.604)	(0.582)
124.hankorg	-1.274	-1.030
	(0.713)	(0.698)
129.hankorg	-1.538**	-1.556**
	(0.493)	(0.524)
134.hankorg	-2.663***	-2.610***
	(0.462)	(0.438)
138.hankorg	-1.219*	-1.117
	(0.556)	(0.606)
141.hankorg	-1.211*	-1.071
	(0.592)	(0.603)
148.hankorg	4.043***	5.055***
	(0.567)	(0.664)
151.hankorg	-2.091	-1.928
	(1.238)	(1.218)
152.hankorg	-1.914**	-1.969**
	(0.586)	(0.601)
158.hankorg	-0.873	-0.964
	(0.760)	(0.891)
170.hankorg	0.229	0.509
	(2.436)	(2.805)
181.hankorg	1.465	1.019
	(0.813)	(0.983)
188.hankorg	0.0335	-0.168
	(0.644)	(0.672)
211.hankorg	-4.713***	-3.649***
	(0.972)	(0.803)
212.hankorg	-2.479*	-2.264*
	(1.115)	(1.117)
222.hankorg	-1.097	-1.217
	(0.691)	(0.728)
242.hankorg	-0.997	-1.139
	(0.626)	(0.640)
250.hankorg	-1.013	-0.914
	(0.700)	(0.657)
251.hankorg	-6.122***	-10.30***
	(0.619)	(1.364)

260.hankorg	-1.413*	-1.487*
	(0.678)	(0.699)
269.hankorg	-0.379	-0.329
	(0.537)	(0.560)
277.hankorg	-5.674*	-5.365*
	(2.595)	(2.205)
283.hankorg	-5.551***	-5.141***
	(1.095)	(0.987)
293.hankorg	-0.780	-0.587
	(1.077)	(1.102)
294.hankorg	-1.946***	-1.728***
	(0.524)	(0.520)
347.hankorg	-0.549	-0.665
	(0.589)	(0.578)
388.hankorg	-0.236	-0.242
	(0.416)	(0.461)
390.hankorg	-0.0729	0.136
	(0.898)	(0.971)
402.hankorg	0.791	0.924
	(0.771)	(0.774)
429.hankorg	-2.448***	-2.518***
	(0.371)	(0.365)
439.hankorg	-1.102	-1.238
	(0.812)	(0.741)
473.hankorg	-4.455***	-4.299***
	(0.397)	(0.413)
475.hankorg	1.634*	1.543*
	(0.733)	(0.734)
479.hankorg	-0.253	0.204
	(0.620)	(0.563)
504.hankorg	-2.746**	-2.596**
	(0.912)	(0.926)
535.hankorg	-2.054	-1.728
	(1.107)	(1.155)
537.hankorg	0.656	0.839
	(0.854)	(0.914)
542.hankorg	-2.205***	-2.230***
	(0.375)	(0.368)
546.hankorg	0.440	0.108
	(1.355)	(1.664)

591.hankorg				1.136**	1.079**
				(0.358)	(0.354)
602.hankorg				-1.518***	-1.956***
				(0.341)	(0.446)
717.hankorg				-4.177**	-4.098**
				(1.538)	(1.514)
803.hankorg				-2.480***	-2.375**
				(0.749)	(0.732)
_cons	0.0806	0.957*	1.385**	0.411	0.546
	(0.311)	(0.481)	(0.471)	(0.460)	(0.443)
N	1765	1765	1765	1765	1765
R^2	0.508	0.501	0.525	0.541	0.563
adj. R^2	0.504	0.494	0.517	0.516	0.538

TABLE 19: Effect of scoring auction in different margins all coefficients

	Y = 1, if n<1	Y = 1, if n<2	Y = 1, if n<3	Y = 1, if n<4	Y = 1, if n<5	Y = 1, if n<6	Y = 1, if n<7
scoring_auction	-0.0260	-0.0187	0.0324	-0.0303	-0.0747*	-0.0810**	-0.0623*
	(0.0166)	(0.0253)	(0.0317)	(0.0331)	(0.0333)	(0.0308)	(0.0284)
other_auction	-0.0831	0.171	0.0615	0.310	0.0973	-0.0754	-0.118
	(0.0491)	(0.272)	(0.225)	(0.212)	(0.148)	(0.186)	(0.169)
restricted_entry	0.0183	0.0165	0.0742	0.0108	-0.0514	-0.118	-0.167**
	(0.0294)	(0.0432)	(0.0611)	(0.0655)	(0.0677)	(0.0661)	(0.0641)
negotiations	0.163	0.0856	-0.137	-0.181	-0.0176	0.106	0.0690
	(0.139)	(0.177)	(0.186)	(0.178)	(0.168)	(0.166)	(0.157)
partial_accepted	-0.00147	-0.0732*	-0.0833*	-0.160***	-0.237***	-0.218***	-0.263***
	(0.0194)	(0.0305)	(0.0413)	(0.0438)	(0.0433)	(0.0447)	(0.0420)
registrations	-0.00139***	-0.00630***	-0.0118***	-0.0146***	-0.0164***	-0.0161***	-0.0142***
	(0.000375)	(0.000687)	(0.000920)	(0.00105)	(0.00103)	(0.000960)	(0.000902)
estimated_value	0.000432	0.0108***	0.0142**	0.0200**	0.0243***	0.0166*	0.0115*
	(0.00161)	(0.00299)	(0.00542)	(0.00610)	(0.00661)	(0.00656)	(0.00576)
non_municipal	-0.0298	-0.189***	-0.191**	-0.240**	-0.319***	-0.179*	-0.166*
	(0.0290)	(0.0409)	(0.0680)	(0.0780)	(0.0770)	(0.0767)	(0.0703)
site_preparation	-0.00921	-0.0687	-0.117*	-0.130*	-0.208***	-0.138**	-0.151**
	(0.0249)	(0.0385)	(0.0471)	(0.0513)	(0.0541)	(0.0528)	(0.0535)
construction_and_civil	-0.0195	-0.0683***	-0.0980***	-0.102***	-0.0852**	-0.0613*	-0.0325
	(0.0117)	(0.0207)	(0.0268)	(0.0288)	(0.0282)	(0.0260)	(0.0232)
building_installation	0.00649	-0.00980	-0.0518	-0.0799	-0.0501	-0.0635	-0.0359
	(0.0242)	(0.0355)	(0.0429)	(0.0440)	(0.0425)	(0.0412)	(0.0373)
building_completion	0.0359	0.210**	0.177*	0.152*	0.130*	0.105*	0.100**
	(0.0422)	(0.0756)	(0.0736)	(0.0729)	(0.0613)	(0.0475)	(0.0378)

machinery_and_operator	-0.0173	-0.0403	-0.174*	-0.188*	-0.210**	-0.290**	-0.224*
	(0.0244)	(0.0440)	(0.0682)	(0.0763)	(0.0789)	(0.0900)	(0.0902)
3.hankorg	0	0	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
4.hankorg	0.101***	0.274***	0.284*	0.252	0.0748	0.0876	0.0927
	(0.0302)	(0.0427)	(0.133)	(0.154)	(0.146)	(0.127)	(0.0972)
5.hankorg	0.0447	0.0330	0.738***	0.568***	0.290*	0.184	
	(0.0299)	(0.0420)	(0.132)	(0.155)	(0.147)	(0.127)	
6.hankorg	0.0214	0.0130	0.520*	0.643***	0.349*	0.257	0.122
	(0.0222)	(0.0320)	(0.252)	(0.161)	(0.161)	(0.152)	(0.121)
8.hankorg	0.101*	0.319***	0.307*	0.358*	0.243	0.322*	0.241*
	(0.0405)	(0.0588)	(0.140)	(0.161)	(0.152)	(0.130)	(0.101)
9.hankorg	0.0489*	0.375**	0.364	0.312	0.178	0.0448	0.0138
	(0.0244)	(0.144)	(0.190)	(0.200)	(0.197)	(0.186)	(0.160)
10.hankorg	0.0956***	0.310***	0.333*	0.351*	0.258	0.225	0.0313
	(0.0268)	(0.0459)	(0.138)	(0.162)	(0.155)	(0.142)	(0.120)
11.hankorg	0.0149	0.186*	0.319*	0.106	-0.196	-0.163	-0.151
	(0.0186)	(0.0908)	(0.159)	(0.175)	(0.168)	(0.159)	(0.142)
12.hankorg	0.0495	0.173**	0.0981	0.0694	-0.0895	-0.0549	-0.0961
	(0.0342)	(0.0609)	(0.142)	(0.165)	(0.160)	(0.143)	(0.115)
13.hankorg	0.0403	0.289***	0.298*	0.214	0.0309	-0.00231	0.00359
	(0.0212)	(0.0718)	(0.144)	(0.166)	(0.158)	(0.141)	(0.116)
16.hankorg	0.0819*	0.158***	0.0708	-0.00115	-0.0522	-0.0472	-0.0552
	(0.0330)	(0.0437)	(0.134)	(0.158)	(0.150)	(0.131)	(0.104)
22.hankorg	0.0179	0.131	0.0325	-0.0688	-0.244	-0.142	0.0518
	(0.0186)	(0.0938)	(0.176)	(0.203)	(0.201)	(0.191)	(0.136)
24.hankorg	0.0494	0.132**	0.0838	0.195	-0.0339	0.00229	-0.0548
	(0.0322)	(0.0506)	(0.140)	(0.160)	(0.151)	(0.132)	(0.104)
25.hankorg	0.0574*	0.287*	0.314	0.203	0.127	0.211	0.205
	(0.0259)	(0.144)	(0.205)	(0.229)	(0.201)	(0.136)	(0.140)
31.hankorg	0.0766	0.249**	0.223	0.242	0.125	0.0695	0.00885
	(0.0492)	(0.0835)	(0.155)	(0.174)	(0.159)	(0.140)	(0.115)
38.hankorg	0.0113	0.153	0.133	0.0750	-0.129	0.0480	0.00345
	(0.0184)	(0.0835)	(0.167)	(0.189)	(0.186)	(0.147)	(0.115)
40.hankorg	0.0208	0.0824**	-0.0378	-0.0819	-0.145	-0.131	-0.0266
	(0.0220)	(0.0315)	(0.134)	(0.160)	(0.155)	(0.137)	(0.108)
41.hankorg	0.334***	0.441***	0.366*	0.365*	0.190	0.172	0.0459
	(0.0920)	(0.100)	(0.161)	(0.173)	(0.161)	(0.137)	(0.112)
43.hankorg	0.0558*	0.173***	0.144	0.112	0.0393	0.0764	0.0375
	(0.0229)	(0.0337)	(0.130)	(0.154)	(0.146)	(0.126)	(0.0969)
46.hankorg	0.0363	0.161	0.454	0.303	0.582**	0.402*	0.389***
	(0.0370)	(0.109)	(0.524)	(0.537)	(0.214)	(0.165)	(0.116)
48.hankorg	0.0519*	0.305***	0.277	0.394*	0.236	0.290	0.197
	(0.0222)	(0.0746)	(0.151)	(0.186)	(0.177)	(0.160)	(0.137)

50.hankorg	0.0823**	0.205***	0.172	0.113	0.0324	0.0843	0.0712
	(0.0261)	(0.0344)	(0.130)	(0.153)	(0.145)	(0.125)	(0.0957)
56.hankorg	0.0222	0.163***	0.218	0.187	0.0788	0.0731	0.0524
	(0.0195)	(0.0435)	(0.137)	(0.160)	(0.150)	(0.131)	(0.101)
61.hankorg	0.126	0.161	0.0858	-0.107	-0.193	0.111	0.0990
	(0.101)	(0.108)	(0.184)	(0.200)	(0.212)	(0.173)	(0.132)
63.hankorg	0.0256	0.461*	0.298	0.527*	0.335	0.251	0.172
	(0.0281)	(0.229)	(0.246)	(0.220)	(0.221)	(0.223)	(0.229)
68.hankorg	0.0323	0.166	0.0713	0.0609	0.0987	0.134	0.163
	(0.0266)	(0.132)	(0.190)	(0.214)	(0.210)	(0.180)	(0.128)
76.hankorg	0.0767*	0.177***	0.168	0.127	0.0171	0.104	0.0580
	(0.0362)	(0.0507)	(0.140)	(0.163)	(0.154)	(0.131)	(0.102)
82.hankorg	0.0123	0.0144	-0.0441	0.0460	-0.252	-0.190	-0.294
	(0.0214)	(0.0353)	(0.196)	(0.244)	(0.240)	(0.221)	(0.201)
88.hankorg	0.125***	0.360***	0.291*	0.261	0.0982	0.103	0.0712
	(0.0342)	(0.0475)	(0.133)	(0.154)	(0.145)	(0.125)	(0.0959)
91.hankorg	0.00783	0.280	0.254	0.258	0.176	0.0533	-0.0606
	(0.0572)	(0.235)	(0.230)	(0.242)	(0.260)	(0.261)	(0.239)
92.hankorg	0.0671	0.270**	0.155	0.115	0.000970	0.173	0.117
	(0.0465)	(0.0868)	(0.155)	(0.178)	(0.171)	(0.140)	(0.108)
93.hankorg	0.0346	0.202*	0.361	0.183	0.0281	-0.0826	0.0918
	(0.0205)	(0.0957)	(0.192)	(0.208)	(0.199)	(0.187)	(0.123)
95.hankorg	0.0103						
	(0.0222)						
101.hankorg	0.0196	0.205	0.172	0.135	0.0269	-0.0804	-0.0214
	(0.0210)	(0.147)	(0.205)	(0.228)	(0.179)	(0.172)	(0.157)
108.hankorg	0.0348	0.0928*	0.0789	0.0536	0.0969	-0.0183	-0.143
	(0.0220)	(0.0373)	(0.226)	(0.269)	(0.255)	(0.244)	(0.234)
109.hankorg	0.0351	0.233***	0.100	0.0420	-0.0112	-0.0407	-0.0947
	(0.0208)	(0.0703)	(0.145)	(0.167)	(0.160)	(0.141)	(0.115)
111.hankorg	0.0185	0.187**	0.208	0.0645	-0.165	-0.125	-0.143
	(0.0228)	(0.0686)	(0.161)	(0.177)	(0.168)	(0.161)	(0.144)
114.hankorg	0.992***						
	(0.0188)						
117.hankorg	0.0229	0.271**	0.368*	0.348	0.184	0.209	0.146
	(0.0189)	(0.101)	(0.173)	(0.185)	(0.168)	(0.151)	(0.114)
122.hankorg	0.0635	0.125**	0.110	-0.000740	-0.0656	-0.0191	-0.0353
	(0.0350)	(0.0400)	(0.142)	(0.165)	(0.161)	(0.140)	(0.110)
124.hankorg	0.0420	0.152*	0.200	0.144	-0.0146	0.110	0.0360
	(0.0216)	(0.0606)	(0.164)	(0.189)	(0.178)	(0.153)	(0.125)
129.hankorg	0.0145	1.002***	0.764***	0.538***	0.231	0.131	0.0266
	(0.0196)	(0.0292)	(0.128)	(0.150)	(0.141)	(0.121)	(0.0920)
134.hankorg	0.0307	0.0745***	-0.0773	-0.259	0.472***	0.387**	0.267**
	(0.0186)	(0.0218)	(0.125)	(0.148)	(0.140)	(0.121)	(0.0921)
138.hankorg	0.193	0.195	0.463*	0.272	0.158	0.229	0.125

	(0.155)	(0.150)	(0.221)	(0.230)	(0.185)	(0.126)	(0.0975)
141.hankorg	0.0392	0.0965**	0.0603	0.000271	-0.00589	0.123	0.0319
	(0.0240)	(0.0322)	(0.140)	(0.167)	(0.167)	(0.145)	(0.121)
148.hankorg	0.0481	0.213***	0.0893	-0.0125	-0.220	-0.358**	-0.463***
	(0.0287)	(0.0424)	(0.134)	(0.157)	(0.149)	(0.131)	(0.103)
151.hankorg	0.0520*	0.153***	0.149	-0.0251	0.0260	0.249	0.207
	(0.0231)	(0.0355)	(0.179)	(0.199)	(0.237)	(0.213)	(0.154)
152.hankorg	0.129*	0.351***	0.251	0.336	0.169	0.175	0.0402
	(0.0631)	(0.0921)	(0.155)	(0.178)	(0.169)	(0.146)	(0.122)
158.hankorg	0.0296	0.0850*	-0.0927	0.326	0.0641	0.159	0.0447
	(0.0227)	(0.0377)	(0.138)	(0.273)	(0.277)	(0.208)	(0.200)
170.hankorg	0.0483	0.129**	-0.0487	0.173	-0.0147	0.201	0.0872
	(0.0256)	(0.0408)	(0.140)	(0.277)	(0.258)	(0.279)	(0.259)
181.hankorg	0.0215	0.224*	0.0948	0.0491	-0.248	-0.242	-0.378*
	(0.0259)	(0.104)	(0.171)	(0.202)	(0.187)	(0.187)	(0.173)
188.hankorg	0.0327	0.113***	0.105	0.138	0.0377	-0.0144	-0.143
	(0.0236)	(0.0321)	(0.145)	(0.175)	(0.167)	(0.149)	(0.127)
211.hankorg	0.0604*	0.254***	0.220	0.158	-0.00406	-0.0966	-0.199
	(0.0278)	(0.0394)	(0.133)	(0.156)	(0.148)	(0.130)	(0.102)
212.hankorg	0.160	0.219	0.0616	0.150	0.158	0.313*	0.206
	(0.121)	(0.118)	(0.172)	(0.230)	(0.232)	(0.151)	(0.126)
222.hankorg	0.0174	0.0227	0.217	0.434	0.146	0.261*	0.142
	(0.0216)	(0.0283)	(0.270)	(0.239)	(0.233)	(0.127)	(0.0975)
242.hankorg	0.0131	0.336**	0.435**	0.447**	0.286	0.188	0.0990
	(0.0199)	(0.110)	(0.167)	(0.167)	(0.151)	(0.132)	(0.107)
250.hankorg	0.0860	0.230**	0.219	0.0226	0.0306	0.0341	0.133
	(0.0571)	(0.0813)	(0.160)	(0.178)	(0.170)	(0.152)	(0.117)
251.hankorg	0.0746**	0.214***	0.154	0.130	1.008***	0.981***	0.817***
	(0.0252)	(0.0438)	(0.137)	(0.161)	(0.154)	(0.141)	(0.120)
260.hankorg	0.0167	0.193	0.326	0.457*	0.330*	0.237	0.123
	(0.0191)	(0.155)	(0.239)	(0.192)	(0.147)	(0.129)	(0.100)
269.hankorg	0.0280	0.0542	0.180	0.631***	0.320*	0.207	0.0823
	(0.0218)	(0.0333)	(0.288)	(0.156)	(0.149)	(0.130)	(0.101)
277.hankorg	0.145*	0.117	0.610	0.268	0.305	0.281	0.211
	(0.0657)	(0.281)	(0.376)	(0.358)	(0.291)	(0.296)	(0.259)
283.hankorg	0.0945*	0.329***	0.108	0.211	0.590**	0.533***	0.389**
	(0.0384)	(0.0829)	(0.157)	(0.196)	(0.182)	(0.147)	(0.119)
293.hankorg	0.0512*	0.144***	0.180	0.0584	-0.189	-0.193	-0.0925
	(0.0234)	(0.0356)	(0.175)	(0.195)	(0.192)	(0.187)	(0.178)
294.hankorg	0.0423	0.209***	0.283*	0.189	0.128	0.0975	0.0673
	(0.0216)	(0.0498)	(0.140)	(0.162)	(0.151)	(0.136)	(0.110)
347.hankorg	0.0900	0.188*	0.140	0.211	0.00231	-0.0357	-0.0179
	(0.0686)	(0.0893)	(0.166)	(0.187)	(0.173)	(0.158)	(0.131)
388.hankorg	0.0160	1.002***	0.748***	0.509***			
	(0.0215)	(0.0294)	(0.128)	(0.151)			

390.hankorg	0.0452*	0.137***	0.0929	0.101	0.00589	-0.0187	0.0205
	(0.0220)	(0.0351)	(0.156)	(0.198)	(0.191)	(0.177)	(0.152)
402.hankorg	0.0464*	0.139***	0.0859	-0.0873	-0.293	-0.191	-0.339*
	(0.0216)	(0.0303)	(0.144)	(0.164)	(0.163)	(0.172)	(0.155)
429.hankorg	1.005***	0.972***	0.721***	0.495***	0.197	0.107	0.0148
	(0.0182)	(0.0213)	(0.125)	(0.148)	(0.140)	(0.120)	(0.0911)
439.hankorg	0.0209	0.0463	0.657**	0.458	0.347*	0.247	0.149
	(0.0234)	(0.0398)	(0.232)	(0.243)	(0.152)	(0.132)	(0.101)
473.hankorg	0.0506*	0.153***	1.034***	0.860***	0.579***	0.463***	0.309**
	(0.0226)	(0.0301)	(0.128)	(0.150)	(0.143)	(0.123)	(0.0945)
475.hankorg	0.000197	-0.0524*	-0.0724	0.126	-0.178	-0.265	-0.0178
	(0.0184)	(0.0232)	(0.244)	(0.321)	(0.318)	(0.308)	(0.0915)
479.hankorg	-0.00502	0.289	0.0844	-0.118	0.252	0.162	0.0495
	(0.0340)	(0.179)	(0.209)	(0.222)	(0.152)	(0.131)	(0.101)
504.hankorg	0.0389	0.288*	0.224	0.365	0.212	0.224	0.0943
	(0.0207)	(0.131)	(0.195)	(0.212)	(0.187)	(0.167)	(0.148)
535.hankorg	0.0214	0.188	0.0441	0.204	0.270	0.176	0.0472
	(0.0264)	(0.202)	(0.250)	(0.258)	(0.208)	(0.190)	(0.171)
537.hankorg	0.105	0.119	-0.0952	-0.166	-0.240	-0.0272	-0.0405
	(0.105)	(0.106)	(0.164)	(0.196)	(0.202)	(0.186)	(0.141)
542.hankorg	0.0140	-0.00000238	0.783***	0.568***	0.277*	0.195	0.0974
	(0.0180)	(0.0209)	(0.125)	(0.148)	(0.140)	(0.120)	(0.0913)
546.hankorg	0.0373	0.130***	0.0117	-0.153	0.125	-0.00585	-0.129
	(0.0229)	(0.0297)	(0.128)	(0.152)	(0.394)	(0.365)	(0.369)
591.hankorg	0.00764	-0.0161	-0.256*	-0.476**	0.229	0.139	0.0427
	(0.0182)	(0.0210)	(0.125)	(0.148)	(0.140)	(0.120)	(0.0910)
602.hankorg	0.00525	0.0104	0.828***	0.643***	0.324*	0.247	0.119
	(0.0304)	(0.0407)	(0.132)	(0.154)	(0.146)	(0.127)	(0.0982)
717.hankorg	0.0451	0.123*	-0.00493	0.598*	0.586**	0.496**	0.349*
	(0.0241)	(0.0483)	(0.145)	(0.303)	(0.186)	(0.175)	(0.141)
803.hankorg	0.0986	0.348***	0.389**	0.358*	0.285	0.192	0.175
	(0.0521)	(0.0827)	(0.147)	(0.167)	(0.153)	(0.135)	(0.102)
_cons	0.00905	0.0909***	0.397**	0.650***	0.966***	1.053***	1.127***
	(0.0189)	(0.0239)	(0.127)	(0.149)	(0.141)	(0.121)	(0.0920)
N	1765	1763	1762	1754	1744	1721	1695
R^2	0.105	0.153	0.194	0.237	0.273	0.291	0.300
adj. R^2	0.055	0.106	0.150	0.195	0.233	0.251	0.261

FIGURE15: Price and scoring preference bidder descritpive statistics from Stata

```
. tabstat isMicro isSME isLarge n_of_registr n_made_offers ratio_bids, by(bidderType) stat(n mean sd min max q) col(stat)

Summary for variables: isMicro isSME isLarge n_of_registr n_made_offers ratio_bids
     by categories of: bidderType
```

bidderType	N	mean	sd	min	max	p25	p50	p75
Comparison	404	.25	.4335496	0	1	0	0	.5
	404	.6410891	.4802758	0	1	0	1	1
	404	.1089109	.3119137	0	1	0	0	0
	437	31.32037	26.71559	5	204	14	25	40
	437	11.11899	8.896682	5	79	6	8	13
	437	.4466092	.2303829	.0657895	1	.255814	.3947369	.5833333
Quality	30	.1666667	.379049	0	1	0	0	0
	30	.7333333	.4497764	0	1	0	1	1
	30	.1	.3051286	0	1	0	0	0
	33	59.21212	52.73386	9	310	31	49	82
	33	14.81818	11.69256	5	59	7	10	20
	33	.2822349	.1152247	.0595238	.5555556	.2068966	.2777778	.3414634
Price	22	.1363636	.3512501	0	1	0	0	0
	22	.5	.5117663	0	1	0	.5	1
	22	.3636364	.492366	0	1	0	0	1
	26	72.80769	34.54507	10	145	55	64	82
	26	28.38462	17.02017	5	61	13	25.5	39
	26	.3936907	.1623167	.125	.7741935	.254902	.3667586	.5
Total	456	.2390351	.4269626	0	1	0	0	0
	456	.6403509	.4804246	0	1	0	1	1
	456	.120614	.3260359	0	1	0	0	0
	496	35.35081	31.53869	5	310	14.5	27	45.5
	496	12.27016	10.41287	5	79	6	9	14
	496	.432899	.2251643	.0595238	1	.25	.3813853	.5555556

Table 20: Results for joint F-tests for added variables

Results for joint F-tests for added variables		
MODEL 2	F(3, 1815)	67.32
	Prob > F =	0.0000
MODEL 3	F(2, 1756)	30.79
	Prob > F =	0.0000
MODEL 4	F(5, 1751)	20.10
	Prob > F =	0.0000
MODEL 5	F(15, 1742)	11.27
	Prob > F =	0.0000
MODEL 6	F(15, 1737)	4.26
	Prob > F =	0.0000
MODEL 7	F(81, 1676)	2.79
	Prob > F =	0.0000
MODEL 8	F(5, 1671)	16.74

Prob > F = 0.0000